THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twenty-fourth Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 8, 1901.

To the Members of the Western Gas Association: The 24th annual meeting of the Western Gas Association will be held in Louisville, Ky., May 15, 16 and 17, 1901, and will be called to order by the President, Mr. Ira C. Copley, of Aurora, Ills., at 9:30 A.M., Wednesday, May 15th.

The Galt House has been selected as headquarters, and the meetings will be held in a suitable room contained therein. The following rates have been obtained: European plan, $1.50 to $2 per day; American plan, $3 per day. Rooms with bath, from 50 cents to $2 per day, according to location. The Louisville Hotel offers similar rates. Sealbach's Hotel, European plan, $1 per day. It is especially suggested that those proposing to attend the meeting write well in advance for hotel accommodations, in order that certain comfort may be secured and assured.

The Executive Committee has arranged for the presentation of the following papers:

"Recuperative Furnaces of To day: Directions for Operating and Testing;" by Mr. W. E. Steinwedell, Belleville, Ills.

"Six Months' Experience in the Operation of Inclined Retorts;" by Mr. A. H. Barret, Louisville, Ky.

"Taxation of Gas Companies;" by Mr. George McLean, Dubuque, Ia.

"Method of Keeping Prepayment Meter Accounts;" by Mr. Ernest Wm. Bell, St. Louis, Mo.

"Gas Association Libraries;" by Mr. F. H. Shelton, Phila., Pa.

"A Stormy Experience;" by Mr. John Gimper, Galveston, Tex.

"Gas and Hygiene;" by Mr. James Ferrier, Columbus, Ga.

"Wrinkle Department;" edited by Mr. F. H. Shelton, Phila., Pa.

"A "Short Topic" on the subject of "Isolated Generators for Bench Firing;" by Mr. Henry L. Doherty, Denver, Col.

Reports will be received from the Conference Committees on "Municipal Ownership" and the "National Bureau of Advertising."

The Western Passenger Association (from points in Eastern and trans-Missouri territories), the Central Passenger Association, the Trunk Line Association and the Southeastern Passenger Association have granted rates of 1 and ⅓ fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all States east of the Mississippi river, except New England. The following States and Territories west of the Mississippi river are in the territory covered by the Railway Association granting reductions: North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first-class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, 1 first class ticket to Louisville, which certificate, after it has been signed by the Secretary of the Association, and a representative of the above Passenger Associations, will entitle the purchaser to a ⅓ rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Louisville, obtaining a certificate, which will, if properly indorsed in Louisville, entitle them to ⅓ fare returning to place from which certificate was obtained, provided it is indorsed by a representative of the Passenger Associations (who will be present at the meeting) and the undersigned.

Those who live in Western Passenger Association territory should consult local agent several days in advance of purchasing ticket to Louisville, in order to reach an understanding with the different roads

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MAY 13 1901

as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can re-buy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

Tickets can be purchased under the above arrangement on or after May 11, and are good, returning from Louisville, on or before May 21.

A banquet, to be provided by the Association, will be held Thursday evening, May 16, at the Galt House, tickets for which will be sold at $5 each. As it is necessary that arrangements for this banquet should be perfected at an early date, it is requested that those who expect to attend the meeting will notify the Secretary as early as possible of the number of tickets they will require. While the ladies will not participate in the banquet, ample arrangements will be made for their entertainment.

The calling of the roll this year will be omitted. Every member attending will deposit, upon entering the meeting room, a special card which will be furnished him, and upon which he will write his name and address.

For the first time we are to meet in a city where the local gas company has in successful operation inclined retorts, which fact alone will be instructive and add to the interest of the meeting.

All queries sent to the Secretary for the Question Box will be assigned, in advance of the meeting, to members for answer.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association. JAS. W. DUNBAR, Secretary.

BRIEFLY TOLD.

THIS WEEK AT LOUISVILLE.—The Western's 24th annual meeting, at Louisville, Ky., this week, has had much heralding; and it is quite certain that those who are to share in its proceedings will not regret the time and cost involved in their attendance. As said last week, we know that a large delegation, numerically and otherwise, from this quarter or section of the States, will be in Kentucky's main city on the days appointed for the holding of the convention. In fact, we are quite satisfied that the representation on all accounts will be of the fraternal character which has always marked the assemblings of the Western Gas Association. The programme specifies, among other things, that the Honorable Charles P. Weaver, Mayor of Louisville, will instill a welcome to the members and their guests, and that the reply thereto shall be distilled by Captain W. H. White. Under the circumstances, how may it be denied that inspiration will follow the inspiring. Pleasantries aside, it is a certainty that, from introduction to dismissal, if predicting from appearances counts for truth, the Western's 24th, under the leadership of President Copley, is bound to be a rousing success. Save for the fact that a banquet is to be held at the Galt House, the evening of the second day, the programme is bare of any allusion to further entertainment; but the best of the latter will be revealed when the Second Vice-President, and his capably culpable associates of the local committee, have finished their efforts.

NOTES.—"A. V. T.," writing to the JOURNAL, under date of the 8th inst., substantially says: Editors AMERICAN GAS LIGHT JOURNAL: I beg to call your attention to an error in reproducing the article entitled, "The Quantitative Estimation of Hydrogen Sulphide in Illuminating Gas," from the *Journal of American Chemical Society*, as it appears in your issue of April 29, 1901, p. 647. Line 17 should read: "* * * Where boxes are run in parallel, *it* presents a ready means of ascertaining," etc. Of course, the italicized "it" refers to the meat of Mr. C. C. Tutwiler's article, which is, by-the-way, an article well worthy of close study.——The Atlas Pipe Wrench Company, of New York and San Francisco, will show a complete assortment of its wares at the Pan-American Exposition, Buffalo, N. Y.——A meeting of the shareholders in the Rome (N. Y.) Gas Light Company is called for the 22d inst., for the purpose of indorsing and ratifying the sale of its franchises and properties to the syndicate that has made a satisfactory bid for the same. ——At the annual meeting of the Pittston (Pa.) Gas Company a rather queer happening occurred. Five Directors were to be chosen, but only three were elected—Messrs. A. Nesbit, E. H. Jones and E. W. Mulligan. A tie vote for the other contestants (four in number) was recorded.—— The shareholders in the Cincinnati Gas Light and Coke Company have ratified the proposition of the management to absorb the local electric lighting companies, to increase the capital stock from $9,500,000 to $28,000,000, and to increase the number of Directors from 7 to 15. As a result of the balloting for the new Board 9 were named by the gas interests. General Hickenlooper will undoubtedly be named as the Company's executive head, which, as was heretofore said in the JOURNAL, is to be known as the Cincinnati Gas and Electric Company.—— The Pacific Gas Improvement Company, of San Francisco, Cal., is to erect a handsome office building on Sutter street.

A New Method for Illuminating with Incandescent Gas Mantles.

[Prepared for the JOURNAL by MR. FREDERIC EGNER.]

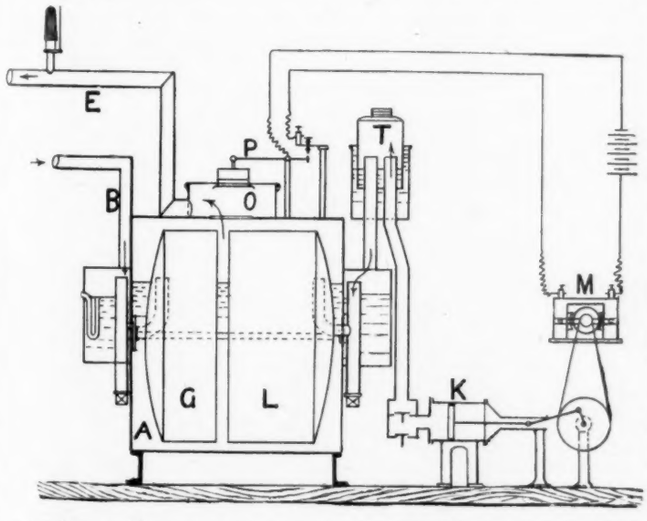
That our trans-Atlantic collaborators are very slow in some directions, while exceedingly progressive and thorough in others, as we ourselves for that matter may also be justly charged with, eliminating the word "thorough" only, may again be illustrated by their now taking up much time at certain of their Gas Association meetings with our pretty well threshed out subject as to whether a certain amount of *atmospheric* oxygen admitted with the gas at the inlet of the purifiers is beneficial—that is, as to whether or not the practice "pays." Before going further in the matter, the writer would like to pay his compliments to Mr. Walton Clark, General Superintendent of the United Gas Improvement Company, for his timely and adroit coining of a technical expression on the occasion when, at the recent meeting of the New England Association of Gas Engineers, a like subject was under discussion; for Mr. Clark, with admirable ingenuity, turned an expression into good "gas English," as we may now call it, which at first threatened to lead to a general public misunderstanding outside of technical circles. Hence, please note, Mr. Reader, it is now "atmospheric oxygen," and no longer—but we shall suppress the word in its common acceptance. The gas man who cannot take the hint should go into some other business. Having given, it is hoped, a clear (?) definition as to what atmospheric oxygen is, let me proceed with the story. It will no doubt surprise a few of the readers of the JOURNAL to be told that the already good incandescent system of gas lighting, deservedly known as the "Auer" or the Welsbach light, has been further improved so as to give a still better illumination with but one-third as much gas consumption than the already great reduction made possible by the light named. It is, however, a fact that gas is holding more than its own as a means of not only the best but also the cheapest light giving medium, and while we have the use of gas for domestic purposes, and a general immense cheapening of power for manufacturing purposes to fall back upon, it is not at all necessary to do this to enable the gas man "to keep his end up" in competition with "our friend the enemy," the electric light. And this is true, even though the improved "Nernst" incandescent electric lamp system is pretty near now to becoming a commercial success. It seems indeed to the writer, that it would be good, up-to-date business for the electricians to at least abandon the soon-to-be-obsolete steam engine, and adopt the gas engine instead, since that would save them from 50 to 90 per cent. in coal bills "sure;" though it would add something to the profit of the gas man, of course.

"The Selas Light" is the name of the latest competitor for public favor, and we are indebted to the German *Journal of Gas Lighting* for details, which, however, were first published in a paper read by Herr G. Mollberg, of Greiz, nearly a year ago, and elaborated by Herr Bessin, of Berlin, only the past month.

Experiments, originally commenced in 1891, we are told finally have resulted in reliable demonstrations which make gas to a still greater degree than it already is by far the cheapest illuminant known. That when both gas and air were mixed under a slightly increased pressure at the burner tip of the Welsbach mantle, the result would be a considerable augmentation of the light, has been well known for some time. The "Kern" burner partly grew from this knowledge; a description of which is probably not necessary, since everybody has either seen or is using it. For large halls, etc., special appliances to supply air under pressure with the gas, to obtain this increase in efficiency of the mantle burners, have been installed at many places; but the Selas light is said to be both the best and simplest of them all, and while it will take time to introduce it for general domestic lighting, it will no doubt be adopted speedily in places where large quantities of light are needed. With the "Kern" burner and the sometimes styled "Pressed gas" and "Pressed air" devices for increasing the light of the incandescent mantles, the mixture of gas and air is brought about at the burner tip, or in the Bunsen tube; and while by use of the latter device the light is thus greatly augmented, the life of the mantle is generally shortened, in some instances bringing it down to only about 50 hours. This must not be understood as referring to the "Kern" burner, but to those devices, used to quite an extent in foreign countries, where air compressed by machinery is conducted to the burner, there to mix with the gas used either compressed or under ordinary pressure. While the increase in light was marked, the cost of installing such a plant, as well as the short life of the mantles already referred to, did not commend the system so that it was gen-

erally adopted. Still it was used in a number of places as stated. Now, with this latest improvement, the gas and air are mixed *at the meter*, in the proportion exactly of one of gas to two of air. Such an accurate adjustment was also out of the question with all the other devices. The result of the arrangement is that with a little better light, the saving in gas is from 45 to 66 per cent., while the life of the mantles is actually increased by reason of the hotter *and stiffer* flame. Another advantage is that much smaller mantles may be employed with equally good results—this last item also being a factor in the longer life of the mantles, because less weight has to be supported by the respective particles forming the mantle. The apparatus consists of a peculiarly constructed wet meter, and other details which may thus be described. The meter contains two drums, each in a compartment of its own, but revolving on the same axle. The gas drum of this meter is one half the size of the air drum, and the gas going through the meter furnishes the power to draw in the air.

The relative dimensions of the two drums of the meter thus accurately regulate the proportions of gas and air which reach the burner, the same being intimately mixed on passage to that point. Not only is the constant proportion of the mixture and consequent flame temperature assured in this manner, but a device is added which also absolutely regulates the pressure under which the mixture is consumed at the burner, thereby adding not only to the life of the mantle but to the constancy of the light emitted as well. This is brought about as follows: Over the compartment containing the gas measuring and mixing drums of the apparatus is a small chamber, furnished with a flexible, weighted diaphragm; this, in turn, is connected with a contact lever, which, by means of a battery or other source of electric supply of energy, can start or stop a small motor, driving either an air pump, or else, by means of suitable gearing, the air drum of the meter itself. Should the gas pressure at any time fall below that required to drive the air drum, or the pressure fall below that desired, and at which the apparatus is adjusted, the above diaphragm sinking starts the motor, which will at once supply the deficiency until the pressure is at its normal rate, when it will be cut out by the diaphragm raising and opening the electric circuit. The quantity of electric current required is said to be not over 20 kw. per annum, and may, therefore, be easily supplied by means of a galvanic battery, suspended weights to be occasionally wound up, or a small water motor instead of the electric device. Of several devices of the apparatus in use the following diagram may serve to more fully



make clear to the reader the general arrangement described in the preceding lines: *A* is the meter case; *G* the gas and *L* the air drum; *B* is the gas inlet; *T* the air inlet; *K* is an air pump moved by *M*, any suitable motor; *O* is the diaphragm chamber and *P* the contact lever, the connected lines indicating the electric connections and battery. At *T* is shown a small regulating holder, the object of which is to eliminate the action of the piston pump, if such should be used. A similar device has long been used in buildings where a gas engine is employed on the same line with the house service pipes. *E* is the outlet pipe, to which a mantle test light is shown attached. Several modifications of the Selas apparatus have been brought out, the tendency being to simplify it; but all have worked most satisfactorily. In one of the earlier devices three drums were contained in the meter case; one for gas, one for air and one to act as mixer. No air pump was used, but actuated in a somewhat similar manner to that just described, the primary air drum was caused to revolve by means of a small dynamo motor and a bevel gear, somewhat like the well known Columbia bicycle. Of course, there is no reason why the gas used should not first pass through the regular consumer's meter, if duplicating the operation of measuring the gas consumed is not objected to. A great many of these Selas lights are now in operation at Berlin, Germany, the second public installation having been introduced at the restaurant of the Berlin Bourse, Sept., 1900. It does seem that this subject is a promising one for American gas companies to look into, and the writer hopes that the present publication may attract the interest which the merits of the system seem to deserve.

Hints on Gas Selling.

[A paper read by MR. JOHN YOUNG, of Norwich, England, at the Twenty-fifth General Meeting, Eastern Counties Gas Association.]

Not many weeks ago, an editorial note appeared in the *Gas World*, commenting upon a semi-private letter which the Editor had received from the manager of a country gas works, complaining that most of the papers read at meetings of Associations were of little or no use to the managers of small works. It is quite true that papers dealing with new departures in engineering, descriptions of large works fitted with every modern invention for conveying and handling materials, slopers *versus* horizontals, or methods of enrichment by means of carburetted water gas, oil gas, or light spirit carburettors, however interesting, are not particularly useful to the manager of the small works. Our Eastern Counties Association is composed largely of managers of small works; and this must be my excuse for selecting a subject which is as old as our profession, is probably worn almost threadbare, and upon which I am afraid I can throw very little additional light. If, however, I am able to give encouragement to any who are despondent, some hints to those who may need them, and, above all, succeed in stirring up some of our members to suggest to us new methods of obtaining business, I shall feel that I have done some little service to the Association.

The Editor said what was wanted by the manager of the small works was more education. Might we not go still deeper, and say it is more ambition that is required? The young manager placed in charge of a small works, fired with a good, honest ambition to rise in his profession, will never cease to educate himself—every difficulty he encounters and overcomes will be a vantage point from which he will obtain a broader view of the field before him, and will be a preparation for overcoming greater difficulties should they arise; and I have little doubt that every difficulty so overcome gives as true a pleasure to the earnest manager as the accomplishment of much greater work gives to his more fortunate brother who, by special training and the force of circumstances, has been entrusted with greater responsibilities. And to every manager there is surely the laudable ambition of increasing and enlarging his business.

The country manager has a great advantage over his brother in the large towns in this respect, that he is known personally to every consumer, and probably to every householder; and it is his own fault if he does not use his personal influence for the good of the business he represents. He must make himself familiar with the best types of fittings, burners, stoves, fires and gas appliances, if possible by actual experiment; and when it is known that the manager is willing and anxious to give advice on these matters, that no amount of trouble is too much for him to take to satisfy his customers, and that his advice, if followed, is sure to give satisfaction to the recipient, he will find that his business will begin to grow. The old style of gas selling, "Take it or leave it," will not do in the Twentieth Century. We must not only court the gas consumer, we must go out of our way to win over the oil consumer also. We have gas for sale for lighting, for fuel and for motive power. Have we done our best to place its advantages before the public, and have we given them sufficient inducement to adopt it for any or all of these purposes? A great philosopher has said: "I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto."

Some time ago a friend directed my attention to the first volume of the *Journal of Gas Lighting*, with the remark that I should find it much more interesting reading than I anticipated. So interesting did I find it that, with your permission, I propose to take my text, as it were, from that volume. First, however, let me say what a pleasure it was to find in the volume some well known names of gentlemen who have contributed very considerably to the success of gas undertakings all

over the world. Every maker of good appliances for the consumption of gas deserves our gratitude—every manufacturer of appliances for lessening the cost of production deserves our gratitude; and I am sure you will be glad that, even at that early date, I found, among others, the names of Sugg, Wright, Glover, Parkinson, Walker, Russell, Oakes, Bryan Donkin, Laidlaw, Harper, Moores, etc.

The first extracts I propose to give are as follows: "It is a well known fact that the profits of a gas company depend mainly upon the quantity of gas they manufacture and supply; the question of quantity being of far more importance than that of price. * * * Quantity being admitted to be the point to be sought for and acquired, it becomes a matter for our consideration how to obtain this." The writer then goes on to give particulars of the benefits obtained by fitting up houses with proper gas fittings at a moderate rental, and concludes his letter with these words: "No other manufacturers have placed so many obstacles in the way of the use of their commodity as gas manufacturers. First, the consumer must pay for his service pipe, then for the meter, and finally for the gas fittings. Supply these things free of charge, and gas will be what it is well fitted for—the universal light." Now, please remember that these words were written over 50 years ago. What have we done since then? In quite a number of places the words might equally well be applied to-day. I regret to say that with some gas suppliers it is still the practice to charge the customer for putting in the service pipes. Surely one of the facilities we must offer is a free service. If the average cost of a service is £1, the interest at 5 per cent. is only 1s. per annum; while a yearly consumption of 10,000 cubic feet of gas will give at least 10s. profit. There are very few business men who would not invest £1 to secure an annual return of 9s.

In these days we have a great advantage over the gentleman who wrote the words I have read to you. In the penny-in-the slot meter we have the handiest and easiest method of dealing with the question of free fittings, or, rather, fittings at a moderate rental. The average cost of fitting a cottage with the penny meter and fittings is £3 1s., the interest on which, at 5 per cent., is 3s. per annum. The usual charge for gas consumed by means of a penny meter is 8d. per 1,000 cubic feet more than the price charged to ordinary consumers; and therefore the consumer who burns 5,000 cubic feet per annum is paying rent for meter and fittings. I am well aware that the penny meter is getting to be a very old song now, but I can assure you that the tune is as melodious as ever. During the quarter ended December 31 last, the quantity of gas registered by penny meters in Norwich was 17,490,000 cubic feet, realizing £3,539 3s. 2d.—an average of 11s. 10¼d. per meter.

There is another point which we must endeavor to attain, and that is, to see that our customers are using the gas we sell to the best advantage. It is not good for the gas supplier if the consumer wastes gas. In the matter of ordinary burners, for instance, it pays to supply the customer with the best article free of charge, and while doing so it also pays to explain the difference between the shape of a flame which is cousuming the proper quantity of gas for which the burner is designed and the shape of the flame from the same burner when gas is being wasted. The country gas manager who carries a few good burners and a small pair of pliers in his pocket is able to do a great deal of good. We know how frequently our gas suffers by being badly consumed; and we often tell people so when they complain. But a man who demonstrates this on the spot, by removing an old worn-out burner and replacing it by a good burner of moderate size, scores at once. Some of us have not yet been able to persuade the powers that be to introduce incandescent lighting for street lamps, although I hope that before long we shall see every public gas lamp in England fitted with incandescent light. Those of us who visited Berlin and Copenhagen with the Institution of Gas Engineers will not readily forget the splendid lighting effects we saw even in the smallest places we passed through. But those of us who are still condemned to use the old burner in our street lamps must see that we use the best burner and give all the light we can for the money. The street lamps are our standing advertisement; and the brighter we can make the streets, the more will the people feel the necessity for good light in their own houses. Our offices ought also to be an advertisement to passers by. Well lighted by incandescent burners, a placard might be prominently displayed; "This office is lighted by gas at a total cost of —— per hour."

In the first editorial of the first volume of the *Journal*, there is this paragraph: "The Economic gas cooking stove, lately registered by Mr. Rickets, is a valuable addition to his other ingenious inventions for increasing the utility and promoting the consumption of gas. At a cost of less than ¾d. per hour (gas being 6s. per 1,000 cubic feet), a large family can provide themselves with fuel for roasting, boiling, stewing, and broiling at all hours without the waste of having to maintain a large coal fire constantly burning, as the gas can be lighted at a moment's notice, and extinguished when the operation is concluded." As an advertisement for gas cookers this paragraph has never been beaten, and with some slight adjustment of the figure stated to be the value of gas required to perform all that is claimed, I can recommend it to you for imitation.

Now, I wish particularly to call your attention to this sentence, which follows on the heels of the one quoted above. "We hope at no distant time to see a gas cooking stove and gas fittings as landlords' fixtures in the humble dwellings of the working population of our cities and towns, as well as contributing to the comforts of the mansions of the rich." In a subsequent number, after calling attention to "gas cooked repasts and ingenious lectures," with which 18 or 20 years previously Mr. James Sharp (then of Northampton) had gratified and instructed the public, and how "we have lately witnessed the celebrated *chef* of the gastronomic art regaling his guests with a monster joint of 565 pounds in weight, cooked in an extempore oven in five hours by 750 cubic feet of gas," the editor makes this prophetic statement: "We have been induced to draw the attention of our readers to this subject from the conviction that therein lays the chief source of the future prosperity of gas companies." Gentlemen, I again remind you that these words were written over 50 years ago. What have the gas sellers of this country been doing since then to fulfil the prophecy? How many of us have pushed this branch of gas selling to its utmost limit? There is no gas works, however small, where there is not room for development in this field. First, we must attract the attention of the public by a little judicious local advertisement. On the back of the gas account, for instance, an illustration of a gas cooker, together with the terms on which it can be rented, would attract attention. In the local papers the words "Try a Gas Cooker," or "Try a Gas Fire—Apply to the Gas Company" would be serviceable. In the parish magazine a small advertisement is often useful. Let me suggest that in advertising something alliterative is very telling. For instance, "Cleanliness, Cheapness, Comfort" to introduce gas fires, or "Efficiency and Economy" for cooker and gas engine advertisements. Then there might be a small exhibit in the office, with some plain but fruitful figures as to the work that can be done for a given quantity of gas. For example:

One Pennyworth of Gas—What it Will Do.

Consumed by an ordinary gas burner, it will give a light equal to 16 candles for 6 hours.

Consumed by an incandescent gas burner, it will give a light equal to 45 candles for 8½ hours.

Consumed by a properly constructed gas fire it will sufficiently heat an ordinary room for 1½ hours.

Consumed by a properly constructed gas cooking stove, it will cook a dinner consisting of soup, fish, joint, vegetables, and pastry, sufficient for 6 persons.

Consumed by a properly constructed water heater, it will heat sufficient water for 2 hot baths.

Consumed by a good gas engine, it will develop 1 horse power for 1½ hours.

Occasionally there should be a course of cooking lectures, demonstrating the utility and economy of gas cooking and the value of gas as a fuel—all this to interest and attract the public. But our enterprise must not stop here. We must be prepared to coax the consumer by the offer of a stove at a moderate rental, by fixing his stove free of charge, and by giving him the best article that we can. Now, you will please observe that I do not advocate the free stove. The free stove customer is not necessarily a desirable customer. He does not care whether he uses the free stove or not; but if a customer pays a moderate rental, he endeavors to get the full benefit out of it. In the good old days, before pigtails and cocked hats had given way to cropped heads and billycocks, it is said a noted personage walked the Strand offering guineas for sale at 1 shilling each, and that not one was sold. If, however, some little trouble had been attached to the purchase, such as filling in an application form and obtaining a landlord's consent, people would probably have been impressed with the importance of the offer, and our friend's guineas would have had a rapid sale. That, at least, is my experience with respect to the free stove customer. In 1897 there were 1,134 free stoves and 463 stoves on hire attached to penny meters in Norwich; and the average annual consumption per penny meter was 6,760 cubic feet. On Dec. 31 last there were only 706 free stoves left, but there were 4,097 stoves on hire attached to penny meters; and the average annual consumption per penny meter had risen to 10,495 cubic feet.

Just a word now about gas fires. They must be of the very best construction; we must fix them free of cost, and we must not seek to make a profit on the sale of them. We are gas sellers, and should endeavor to seek our profits from the sale of gas, and not from trading in iron castings. Speaking as I am to practical men, I need not remind you that it is essential that a good supply of gas should be laid on to each stove, and that the outlet flue should be of sufficient size, and have a good draught. Nothing condemns a gas fire quicker than bad fixing, and that is one reason why I suggest that, by offering special facilities, we should keep this matter in our own hands. You will hardly credit it when I tell you that I have seen gas fires where the outlet flue had been contracted from 3 inches in diameter (the size of the maker's outlet) to 1½ inches; the theory being, as I was informed, that it "held the heat back in the fire." You can imagine the miserable failure of the fire, and the difficulty I had in persuading the suffering customer to try another. In this also we must be prepared to assist the consumer.

The advantages of gas engines, compared with steam engines, especially for intermittent work, must be placed before customers in the strongest possible light. I need scarcely point out that one of the strongest reccommendations we can give is the use of a gas engine by ourselves. In small works especially, the beautiful combinations of gas engine and exhauster produced by the principal makers ought to prove an excellent advertisement. Here, again, we must offer every facility to the customer—free service right up to the engine, and, if necessary, assistance in fixing it. Gas engines, as a rule, are day consumers; and the equalizing of day and night consumption is a step in the right direction for economy. The country manager is often the only man in the town who knows anything about gas engines. He ought to take care that he can give good advice as to the care and management of them; and he should make himself familiar with their construction, so that he can superintend (or even execute) any ordinary repairs that may be necessary. The cleaning and adjusting of a gas engine are often sufficient to cure what has apparently been a hopeless breakdown.

I remember a country manager who had on his committee a gentleman who, at one meeting, complained bitterly of the wretched gas then being supplied. He had a gas engine which had run sweetly for years, but the gas then being supplied had not sufficient power in it to drive his engine. The manager visited the committee man's works, looked at the engine, pulled off his coat, and in a few hours emerged from the struggle, dirty but triumphant. The engine was running sweetly. The committee man was asked to inspect the result, and expressed himself pleased, and inquired what the manager had done. The reply was, "Simply cleaned, and adjusted your engine." The committee man apologized for the trouble given, and remarked that had he thought that was all that was required he would have sent for a fitter. Very likely he would, when convinced; but no amount of argument could have convinced him so well as my friend's action.

Now, gentlemen, we are perhaps tempted to say, "What is the use of all this—where does the advantage come in?" I must quote my text again: "It is a well known fact that the profits of a gas company depend mainly upon the quantity of gas they manufacture and supply." I am loth to burden you with figures, and have avoided doing so as much as possible; but I must endeavor to show how, in one or two items alone, the cost of the gas produced is reduced by the quantity supplied. In Norwich, on Dec. 31, 1897, we had 5,733 ordinary and 2,533 prepayment meters, and the gas sold for the half year was 138,491,000 cubic feet. On Dec. 31st last, we had 6,117 ordinary and 6,194 prepayment meters, and the gas sold was 174,373,000 cubic feet. Excluding the cost of the raw material, the cost of manufacture for the half year ended 1897 was 9.7d. per 1,000 cubic feet of gas sold, while in 1900 it was only 6.3d. What one may describe as standing charges (rates and taxes and management) were reduced by 0.9d., and the amount required for dividend was reduced by 2.1d. per 1,000 cubic feet sold—a total saving of 6.4d. per 1,000 cubic feet sold, due almost entirely to increased consumption. The only items not affected will be the cost of the raw materials for gas production. Increased output effects economy everywhere else.

The introduction of cooking stoves and gas engines has given greater uniformity to the demand for gas. The difference between June and December is not nearly so great as formerly—*e. g.*, the gas sent out in June, 1890, was only 27.6 per cent. of the quantity sent out in December, 1890; whereas the quantity sent out in June, 1900, was 47.6 per cent. of the quantity sent out in December, 1900. Again, the day consumption and night consumption are more uniform. In June, 1890, the day consumption was 47.7 per cent. of the night consumption; whereas in 1900 it was 102.9 per cent. Or, to put it in another form, the day consumption for a week in June, 1890, was 1,005,000 cubic feet, and the night consumption 2,103,000 cubic feet; while in the corresponding week in 1900, the day consumption was 2,505,000 cubic feet, and the night consumption 2,434,000 cubic feet. This, you will readily perceive, promotes economical working.

It is sometimes argued that, as increased day consumption means increased day pressure, therefore the unaccounted for gas will be largely increased. This, however, is not our experience. In the half year ended Dec. 31, 1897, the gas sold was 138,491,200 cubic feet, and the unaccounted for gas was 12,618,700 cubic feet; while in the corresponding half of 1900, the gas sold was 174,373,400 cubic feet, and the unaccounted for gas 12,229,500 cubic feet.

Most of us, at times at least, are tempted to bemoan the meanness of our opportunities, the insignificance of any results that are likely to accrue from our efforts, and are inclined to sit down and dream of the great deeds we could have done had greater scope been given us. When we feel in this frame of mind we must arouse ourselves, for we are confined in a miserable shed called Despondency, in the purlieus of Doubting Castle, guarded by a ragged, tattered lout named Laziness, a myrmidon of Giant Despair. We need not be there long. One vigorous kick at the ramshackle walls, and we are free—free to breathe the fresh, wholesome air of hard work, and enjoy the sunshine of duty done.

As I have already pointed out, each one of us owes a debt to the profession he has chosen, a debt that can only be paid by endeavoring to leave our works and our businesses better than we found them; and this debt is as truly binding upon the manager of the small works as upon any other member of the profession. The satisfaction of having faithfully discharged one's duty is attainable by every one, no matter whether his responsibilities be great or small.

"Who does the best his circumstance allows
Does well, acts nobly; angels could no more."

Electricity in the Sandwich Islands.

By Mr. F. E. Grain, in *Electrical World.*

I first visited the Sandwich Islands in 1899, at a time when the city of Honolulu was filled with troops *en route* to the Philippines. I carefully investigated electrical affairs and found that the progress made was not very marked, although electric lights and power plants had been installed. The city was liberally lighted with electricity and promoters were then introducing plans for the development of the electrical business by establishing electrical street car lines, putting bells into homes, adopting electrical fans, heating devices and the like. This advancement has been steadily in progress, until to-day, when the islands were visited again by your correspondent, it was discovered that not only electric lights were in service to a larger extent than ever before, but electrically driven vehicles were in use, devices for heating by electricity could be found, while electric bells, the telephone and the telegraph had made exceedingly good headway.

I interviewed some of the leading officials of the city of Honolulu, and also spoke with mine owners and proprietors of manufacturing properties in the interior. All of the people of the tropics like the electric light. For many years they have been obliged to use the petroleum oil or candle light, both of which are productive of heat to such an extent that a person cannot very well sit in a room or office in the evening lighted in this manner without suffering from the heat. Along the coast lines of the group which can be reached by wires, and which are subject to shipping, electric lights in signal towers and lighthouses have been liberally provided. I know that in coming into the harbor of Honolulu at night that I saw electrically lighted stations along the coast lines for many miles. When I was here before, only main thoroughfares of Honolulu were lighted by electric lights. Now even the remote streets are thus lighted. Besides this, circuits have been run to the suburbs and to adjoining towns, so that the entire island on which the city is situated is well illuminated at night. The stores of the city have long since put in electric lights. They believe in plenty of light and in advertising with electrical signs. During an evening patrol of the streets on which the leading mercantile houses are located, one will observe very many colored electrical signs of neat design. The mechanical advertising devices are in most instances made here, and I visited one shop in which the workmen were very busy applying mechanisms to advertising signs for the merchants of the city.

I took occasion to visit a number of the machine shops, wood working

establishments, foundries, brick works, cork cutting shops and mills of all sorts, and although in most cases the capacity of the works is small as compared with what we are used to seeing in America, the owners have taken the precaution to put in electric lights. The manufacturers of the country have not had the advantage of good power and transmission facilities and machinery and furnishings of all kinds are short in supply. The result is that the shops and mills are small, lacking in power mechanisms, poorly furnished with modern machinery and fittings, but still fairly well lighted. It looks strange to see great, white lights burning in little 1-horse manufacturing apartments in which the machinery is small, often crude and sometimes entirely absent. Electric lights have also been installed quite freely in the houses of the richer classes. I visited some of the houses of the aristocracy and observed the neat arrangements of lights. Everybody lives outdoors in these climes, and the lights in some cases were arranged for both the interior of rooms and the exterior, so as to throw light on porches, grounds and perhaps street fronts. This is arranged by cutting through the walls of the building and inserting glass globes in the masonry or woodwork. The globe fills the space, and when the light is furnished for it and lighted the reflection is, of course, cast both ways.

I found that considerable demand prevailed throughout the tropics, and especially in Honolulu, for electrical heating and cooking devices. It may seem strange that heating apparatus is needed in the tropics, but there are times when storms occur and when for special reasons heating devices are needed, that some sort of stove is convenient. Several dealers in electrical supplies informed me that they had had calls for electrical cooking apparatus. The application of the electric stove to the sub-tropics is, of course, feasible, for it is in hot climates that such a stove can be used to the best advantage. The present custom of cooking involves the use of stoves, furnaces and devices constructed by hand from stones or clay. The higher classes use imported stoves or oil burners, while at the houses of the middle and lower classes the writer saw some very curious cooking apparatus. Some of it is nothing more than several flat stones arranged in such way that a fire can be made between them and the portions to be cooked are placed above. These stones get heated and retain the heat for a long time, producing discomfort in the houses. If electrical heating and cooking devices were sent to the agents in Honolulu, it would be found that a good demand would prevail very promptly. There are no such stoves in the stores now, but I was told that some would be secured and advertising literature distributed concerning the same upon arrival.

The Hawaiians seemed to me to be especially interested in new inventions and improvements in electrical lines. I know that in cases where electrical bells have been put in, the members of the household are extremely proud of the same. I had occasion to call upon a family, and as I approached the house I observed that the entire family which was seated on the porch entered the house when they saw me approaching. I wondered at this, until I was told later on that they did this so that their visitor would have to use the new system of electrical bells which had been put in. I am informed that when the bells are first installed, the members of the household amused themselves by ringing the bells continuously for hours at a time. Electricians who put in bells tell me that they can get plenty of orders by canvassing the districts. There is considerable room here for the establishing of electrical supply houses and shops for working in this line.

As in most of the tropical cities and towns, the street railway of Honolulu is not yet what it ought to be to keep up with other improvements of the city. I had already found that the street railway of Manila was poorly equipped and totally incapable of accommodating the traffic. An electric line there would be a fortune to its owners, as would a line in Iloilo. At Nagasaki, Japan, and other points in the Far East touched by myself, the need of electric street railways was very evident. In Honolulu, an electric line fitted out the same as our roads in America, would earn rich dividends for the stockholders. At present the cars are old, stuffy and far too small for service. But they could not be any larger and be drawn by the little horses here. The tracks are small and in bad form and would have to be renewed for electrically driven cars. The roads, however, are in fair condition for the operation of an electrical road. One of the principal drawbacks which I found in Nagasaki, Manila and parts of Iloilo was that the streets were too narrow and the roads hardly suitable for electric lines unless considerable work is done. Buildings would have to be torn out in some squares to give room enough to get a car around a corner, so narrow are many of the streets. But in Honolulu there is plenty of space in nearly all of the thoroughfares. The pavement is also in fair order and would not need much repairing or constructing to get into shape for street cars. As to the patronage of a line of this sort in Honolulu, there is no doubting that it would pay well from the start. The traffic of the present road is beyond its capacity and the accommodations are very poor. If such a line were established, freight cars should also be put in, for it is a part of the road's business to carry packages. I know that every time I rode on one of the little bob-tailed cars, the driver had to get down and help some market woman place her load of purchases on a rack arranged in the front of the car. Freight all along the line is picked up. This freightage is charged for and usually at the rate of one passenger. I am of the opinion that there is an abundance of capital in Honolulu with which an electrical road and power station could be put in. The reasons for drawing these conclusions in this city are very similar to those of all other tropical possessions in which I have traveled recently. So many Americans and foreigners of other nations have come into the new possessions of America during the past 2 or 3 years, that modern customs and ideas of home are being introduced with rapidity. You would almost suppose some of these possessions in the Pacific to be American cities or towns because of finding so many Americans and Europeans in them, and because of the introduction of American ideas for running hotels, stores, commercial and general industrial industries. There are American hotels, shops, stores and works everywhere, not alone here in the Hawaiian Islands, but in the Philippines and in Japan. Under these conditions it is not strange that there should be a need of electrical lights, roads and vehicles. I concluded that anyone wishing to start an electrical street railroad in Honolulu would find it best to import some circular saws, planers, tie making machinery and general woodworking devices for operation by steam or water power, or if the plant is installed, by electrical power. The power station would, of course, have to be equipped with engines, boilers and other machinery by importing the same from America or other countries.

For an electrical street road in Honolulu, water power can be employed, as there are several locations where damming can be done and turbine wheels installed for developing the required power. It is probable, however, that the plant would be operated by steam power, and for this purpose there is an abundance of wood for fuel. Fuel is cheap. Not only can wood be cut and hauled to the fireroom at a cost that would be about ⅛ the cost in America, but coal has been discovered, and if needed could be hauled to the furnaces. They say that the cost of this coal is ridiculously small for the reason that the natives employed at getting it out work for about 20 cents per day. The coal runs in leads which are broken, but which are taken up again after digging for a short while. The leads are followed in broken columns through the hills, and such coal as is secured is carted to the city of Honolulu. They have also located petroleum oil wells on one of the islands of the group, and I saw some of this oil in use in a furnace where they were running some lumber machinery. The boiler was 200 horse power. The owners of the plant stated that the cost of generating the steam by this system amounted to about $1.50 per day for the 200-horse power. Fuel is also plenty in the form of charcoal, for there are a number of charcoal plants in working condition, and the charcoal is brought to the consumers in sacks. I also saw some coke from gas works.

Mention must also be made of the electrical vehicles which have been introduced in Honolulu during the past few years. I did not notice any motor carriages when I was here in 1899, but to-day I can see quite a number of horseless carriages running about the streets, nearly every one of which is of up to date pattern. Several of the machines I saw run by electrical power and the owners appear to be getting good results with them. The machines are evidently made for the tropics, for russet colored shades, like umbrellas are provided. The entire machinery equipment is made with a view of use in the tropics, where, as a rule, the roads are always dusty, and the bearings have to be protected, otherwise the fine dust will get into them and cut them. But in all of the tropical countries which I visited I noticed little more dust than in America. There is hardly any need for bothering about the dust. In Honolulu I saw much less dust than often seen in the streets of American cities.

What will necessarily interest the owners of electrical light plants, electrical equipping houses, electrical street railway line promoters and users of electrical vehicles, is the matter of an electrical repair shop. There are no electrically fitted shops in the islands at present in which a specialty is made of repairing and constructing electrical machinery and devices. Nor is there any suitable electrical furnishing house. There is a great opening here for the establishing of a shop in which electrical devices of all sorts can be built and repaired. There is also a

grand chance for someone to open an electrical supply store. At present, if an electrical device of any description is out of order, it is taken to the regular machinists, who may be familiar with ordinary mechanisms, but must experiment with the electrical apparatus before they can get it into running condition; in fact, I know of many instances in which these machinists have put an electrical device completely out of service through poor adjustments and careless handling. Electrical devices, as is known, cannot be trifled with with new hands, yet this is what is being done in the shops of Honolulu, in which the machinists are perfectly competent to repair farming machinery, pumps, water wheels, sewing machines, printing presses, wagons and the like, but are unfamiliar with electrical motors and dynamos and their fittings.

The Design of Steam Power Plants.—No. VIII.—Feed Water Heaters and Economizers.[1]

[By Mr. Henry C. Meyer, Jr., in *Engineering Record.*]

Value of Feed Water Heaters.—Exhaust steam feed water heaters are used to heat the water fed to boilers by steam exhausted by engines and pumps, and the saving due to their use is so great that plants are seldom constructed without them. Generally speaking, for every 11° that feed water is warmed there is a saving of 1 per cent. in the fuel burned. With sufficient exhaust steam available, cold feed water at 70° F. can be raised in temperature to 210°, thus saving over 12 per cent. of the fuel. The heater will in many locations, therefore, reduce the fuel consumption enough to pay for itself in a few months, the exact time depending upon the cost of the fuel.

Types of Heaters.—Exhaust steam feed water heaters are of two types, the open and the closed. In the former, the heater consists of a box like receptacle of cast iron or boiler steel to which the exhaust steam is led so as to fill its interior. The cold feed water is admitted at the top and in most designs trickles to the bottom over a series of trays and is thus brought in contact with the steam and is heated by it. If the water contains scale forming salts which are precipitated at temperatures below 212°, they collect on the trays, which are removable for cleaning. This type of heater sometimes has a filter in its base for further removing these precipitated salts and impurities that can be intercepted by filtration. The feed water is drawn from the bottom of the heater and pumped to the boilers. The pump must be located so as to receive the water under pressure, as it will not lift the water if it is under a high temperature. The condensation from heating systems, the discharge from traps connected to high pressure drips, engine jackets, reheaters, etc., which are to be returned to boilers, can be connected to the heater. A certain water level is maintained in the heater, and to do this the supply of cold feed water is controlled by a valve operated by a float in the heater, so that cold water is admitted when the boiler feed pump draws from the heater faster than it is supplied by the heating returns, drains, etc. It is absolutely essential that an efficient grease separator be placed in the steam pipe leading to an open heater, so that oil cannot enter it and pass on to the boilers mixed with the feed water.

Closed heaters usually consist of a cylindrical shell of cast iron or boiler steel containing tubes extending from one head to the other, or coils of pipe. Sometimes the exhaust steam is admitted to the shell so as to surround the pipes or coils containing the feed water, in which event the heater is said to be of the water tube type. If the steam is inside of the coils with the water surrounding them, it is a steam tube heater. Closed feed water heaters are usually supplied with a steam inlet and outlet, although they are sometimes arranged with only a single connection, reliance being placed on the vacuum that forms in the heater when steam is condensed to cause more steam to flow into it. As a certain amount of air exists in the exhaust steam, this will find its way into the heater and is apt to impair its efficiency. For that reason many engineers believe that there should be a double steam connection, unless some means of removing the air is provided, to prevent air from accumulating and thus to insure a thorough condensation of steam through the heater. Experience has shown in water tube heaters that the best results are obtained when the water is compelled to pass through the tubes successively. Closed heaters are made to rest in a horizontal or vertical position. The latter are to be preferred if it is convenient to use them, as they take up much less floor area and the circulation of water in them is much more thorough.

Uses for Heaters.—The manner in which feed water heaters are used depends upon the type of plant in which they are installed. With non-condensing engines, where the exhaust steam is available for feed water heating, the feed water may be raised to a temperature of about 205° or 210° F.; and when this is done, it is usually the custom to allow 1 square foot of heating surface in brass or copper pipes for every 90 pounds of water passed through the heater per hour. With condensing engines it is frequently the practice to place a feed water heater of the closed type in the exhaust pipe of the engine, unless two different sets of conditions exist. If the air pumps and boiler feed pumps are steam driven, and the steam exhausted by them added to the steam exhausted by any other pumps or steam auxiliaries in the plant amounts to one seventh or more of the steam generated in the boilers, this exhaust steam from the auxiliaries can be led to an auxiliary feed water heater and the feed water warmed by it from about 75° to 210°. In this event, a heater in the exhaust pipe of the engine would be of no value; nor would it, if the feed water were drawn from the condenser discharge, for in that event it would be at nearly as high a temperature as the exhaust steam from the main engine, so that it would hardly pay to attempt to use this steam for heating. The exhaust steam from the main engine being under a partial vacuum, say 26 inches, would have a temperature of about 125°, and the condenser discharge probably about 100°. If the exhaust steam from the auxiliaries be not sufficient in quantity to raise the feed water from a temperature of 60° or 70° to about 210°, then a feed water heater can be placed in the exhaust pipe of the engine and the water warmed from the lower temperature to about 115° and finally passed through an auxiliary heater and there warmed to as high a temperature as possible with the auxiliary exhaust steam available. This auxiliary heater is almost invariably used in the latest plants, while only occasionally is a heater placed in the engine exhaust pipe of a condensing engine. Auxiliary heaters of the closed type should have the same amount of heating surface as heaters receiving steam at atmospheric pressure. This rating was previously given. Heaters placed in the exhaust pipes of condensing engines should have more surface, usually 1 square foot for every 60 pounds of water passed through the heater per hour, this being necessary because the difference between the temperature of the steam and the mean water temperature is less than it is with heaters using steam at atmospheric pressure.

Condensation in Heaters.—The condensation that occurs in a feed water heater amounts to about one seventh of the weight of the feed water passing through the heater, when the water is raised from 70° to about 210°. In an open heater this, of course, mingles with the feed water and passes on to the boilers with it. In a closed heater, the steam not being in contact with the water, the condensation occurring has to be removed from the heater, and this can be done by leading it to a steam trap. It should not be forgotten that the steam pressure in a heater is frequently at practically the same pressure as the atmosphere, hence the discharge from the trap should be carried downward, or on a level rather than upward, as there is no pressure to lift the water. It is not necessary to save the condensation in a closed heater unless the cost of this water which, as has been said, is about one-seventh of the total feed water, is sufficient to make the saving of it advisable; or unless there is not enough exhaust steam to warm the feed water to as high a temperature as may be desirable. If there is plenty of exhaust steam that would otherwise go to waste, available for heating, the heat in this condensation in the heater is of no value. If the condensation from a closed feed water heater is to be returned to the boilers, it should be trapped, and the discharge from the trap led to a receiving tank combined with a pump controlled by the level of the water in the tank. Other drips from the cylinder jackets, high pressure steam pipes, reheating receivers, etc., can also be led to this tank, discharging through a trap, or can be returned to the boilers direct by the steam loop or the Holly system.

Purchasing Heaters.—In purchasing a feed water heater for a power plant for a manufacturing or electric station, the heater is usually purchased by the owner direct, although in some plants, notably those in office buildings, the purchase, delivery and installation of the feed water heater are frequently included in the specifications for the piping. The writer believes that it is much better to make the purchase of these a separate contract. In obtaining bids on heaters the matter of delivery should be decided. The specifications for a closed heater should state the amount of heating surface required, the kind of metal that the tubes are to be made of, whether it is to be of the steam or water tube type, and horizontal or vertical. If the supplying and installation of the heater is to be made part of the contract for the steam piping or some other part of the plant, the contractor undertaking it should be required to deliver and erect. If the heater is to be purchased direct from its manufacturers, the specifications should ask that the bids cover the delivery and erection of the heater in the plant where it is to be used, or

[1] Ante, p. 127.

the delivery free on board cars at the nearest railway point to the power plant, as may be desired. The specifications should ask each bidder to furnish a blue print or drawing showing the details of the construction of the heater it is proposed to furnish, its exact dimensions and the location of the steam and water outlets.

There is no general rule that the writer is aware of for proportioning heaters of the open type. Therefore a specification for a heater of this type should state the quantity of water to be passed through the heater in a given time and also the initial temperature of the water and the final temperature desired. A print or drawing of the heater a bidder is to provide should be obtained and the inside dimensions of the heater, the volume of the steam and water space, etc., should be investigated. The heater must not be too small, otherwise the water in passing through it cannot be broken up in sufficiently small particles to allow the water to mix thoroughly with the steam and thus be sufficiently heated by it. If a guarantee as to the efficiency of a feed water heater is required, it should be in the following form: The maker guarantees the heater to be capable of warming —— pounds of water per hour from a temperature of —— degrees F., to —— degrees F., with sufficient steam at atmospheric pressure.

Economizers.—Economizers are used in connection with steam boilers to warm water either for boiler feeding or for some manufacturing purpose, by the heat in the gases from boilers that would otherwise go to waste. Economizers are also useful in increasing the capacity of a boiler plant already in operation, in providing means for storing a large quantity of water at high temperatures, which is of advantage in the event of a sudden increase in the demand for steam. They also deliver the water to boilers at high temperature and reduce strains in boilers due to the admission of cold water. One disadvantage of economizers is that they reduce the draft slightly owing to the friction of the gases passing through them and to the reduction in temperature of the gases. Provision should be made for this by the use of mechanical draft or of larger chimneys than would be necessary if economizers were not used. In plants already constructed the addition of economizers reduces the coal consumption, and this counterbalances in a measure the loss in draft, as less draft is necessary with them because less fuel is burned.

Economizers consist of vertical cast iron pipes, about 4 inches in diameter and 9 feet long, placed in rows several inches apart, each row being connected at the top and bottom to cast iron headers through which the water is supplied and withdrawn. Economizers are provided with scrapers that encircle the pipes and the scrapers are continuously raised and lowered by a mechanism provided, the power coming usually from a small steam engine. Economizers are placed in brick flues between the boilers and the chimney, and a by-pass flue must be provided for use when the economizer is out of service, either for cleaning, which is necessary at intervals, or for repairs. Economizers are used to a very considerable extent in Europe, more so in fact than in the United States, where engineers are now, however, rapidly appreciating their advantages. When first introduced, a number of failures occurred, mainly due to improper design, because they were either constructed of poor materials improperly put together or there was a lack of sufficient heating surface necessary to make the saving that they should produce. Since the economizer has been perfected and made of durable materials, their advantages have become recognized.

The heating surface in economizers takes the place, in a measure, of additional boiler heating surface. If a boiler is operating under certain conditions so that, with a certain rate evaporation per square foot of heating surface, a certain temperature of waste gases follows, it would be possible to add more heating surface and abstract more heat from these gases; but the boiler heating surface would not be so efficient in doing this as an equivalent amount of economizer surface, for the reason that the average temperature of the water in the economizer is lower than that of the water in the boiler; this causes a more rapid transfer of heat from the gases to the water in the economizers than there would be from the gases to the water in the boiler. The saving that an economizer can produce increases as the flue temperature increases because there is more heat for it to absorb. An economizer can only heat the water to a given point, hence as the temperature of the entering water increases, due to previous heating, as in an exhaust steam heater, the saving possible with the economizer becomes less. If the ratio of boiler heating surface to the amount of coal burned is such that as much of the heat in the waste gases is absorbed as is possible, there is not as much heat left in the gases for the economizers to save as there would be if the ratio of boiler heating surface to the amount of coal burned were less. Barrus, in his book on "Boiler Tests," states in effect that where a boiler is operated most effectually, the temperature of the waste gases should not exceed about 400° F., and boilers are usually so proportioned that about this temperature exists when the highest efficiency is attained. Owing, however, to the accumulation of soot upon the boiler surface or to running at a higher rate of evaporation than the normal, the temperature of the waste gases usually exceeds that given so that an economizer is valuable in even a well proportioned boiler plant. Mr. Barrus gives some excellent data showing the saving made by economizers with low temperatures of flue gases, and they are reproduced in Table I., herewith:

TABLE I.—*Barrus' Tests of Economizers.*

Heating surface, boiler, square feet	1,894	4,058	5,592	3,12
Heating surface, economizer, square feet	1,600	1,920	1,280	1,60
Temperature of gases leaving boiler, degrees	376	361	403	43
Temperature of gases leaving economizer, degrees	231	254	299	27
Temperature of feed water entering economizer, degrees	95	79	111	8
Temperature of feed water entering boiler, degrees	175	145	169	19
Increased evaporation produced by economizer, per cent	10.5	7	9.3	12

Mr. William R. Roney in a paper on "Mechanical Draft" (Transactions, Am. Soc. M. E., Vol. XV.), gives some additional data on the saving due to economizers working under various conditions in nine different plants. They are given in Table II.

TABLE II.—*Roney's Tests of Economizers.*

Plants tested	1	2	3	4	5	6	7	8	9
Gases entering economizer, degrees	610	505	550	522	505	465	490	495	56
Gases leaving economizer, degrees	340	212	205	320	320	250	290	190	29
Water entering economizer, degrees	110	84	185	155	190	180	165	155	13
Water leaving economizer, degrees	287	276	305	300	300	295	280	320	31
Gain in temperature of water, degrees	117	192	120	145	110	115	115	165	18
Fuel saving, per cent	16.7	17.1	11.7	13.8	10.7	11.2	11.0	15.5	16.5

In considering the saving that an economizer produces it is necessary to take into account the interest on the investment and the cost of repairs, cleaning, etc. Economizers cost, it is said, about $5.40 per boiler horse power for plants of 1,000 boiler horse power or over, on the basis of 4.8 square feet of economizer surface per boiler horse power. This includes the cost of the brick setting, delivering and erecting, etc. Three per cent. of the investment will probably do more than pay for the cost of the operation, cleaning and repairs. Assume a 1,000-horse power boiler plant to operate 300 10-hour days per year, that the coal consumption is 3½ pounds per boiler horse power per hour, and that coal costs $3 per ton of 2,000 pounds delivered. The annual fuel cost would then be $15,750, and if an economizer reduced this by 12 per cent., then the saving that an economizer would produce would be $1,890. The cost of the economizer at $5.40 per boiler horse power would be $5,400 and 8 per cent. of this for interest, repairs, operating and cleaning is $432. Deducting $432 from $1,890 would leave a net saving of $1,458, which is sufficient to pay for the economizer in less than 4 years. If the plant was operated continuously, the annual fuel cost would be $45,990, and the net saving $5,085, sufficient to pay for the economizer in about 1 year. The 12 per cent. that was assumed in the previous calculations is a conservative estimate for the saving with a low temperature of feed water. In the four tests made by Mr. Barrus previously noted the average saving was 9.9 per cent. and this was obtained with unusually low temperatures of the escaping gases

due partly to the low steam pressure under which the plants were operated, these varying in the different tests from 68 to 82 pounds. Economizer makers will guarantee that they can produce a saving of 6½ per cent. when the temperature of the water entering them is as high as 200°, the economizers having 4.5 square feet of heating surface per boiler horse power and the boilers working at their normal rating.

[To be Continued.]

Further Notes on Purification of Gas.[1]

By Mr. S. Carpenter, of East Ham, in *Journal of Gas Lighting.*

Coal gas, as it issues from the hydraulic main, contains the following impurities: Ammonia (NH_3), carbonic acid (CO_2), sulphuretted hydrogen (SH_2), and bisulphide of carbon (CS_2). At the outlet of the hydraulic main the gas passes into the condensers, where it is cooled, and the tar and watery vapor are deposited. From these vessels, it goes into the washers and scrubbers, which remove the ammonia from it by "scrubbing" it with ammoniacal liquor and clean water, and also a portion of the carbonic acid and sulphuretted hydrogen. The remaining operations in the purifying process are effected in the purifiers.

At the outlet of the scrubbers the gas should be tested for ammonia by the Referees' test, which is performed in the following way: Take 50 septems of the test acid, and pour it into a glass cylinder made for the purpose. Care should be taken to well wet the whole interior surface, and also the glass beads with which the cylinder is charged. Connect one terminal tube of the cylinder with the gas supply, and the other with the meter, and make the gas pass at the rate of about 0.5 foot per hour. Any ammonia in the gas will be arrested by the sulphuric acid, and a portion will be neutralized thereby. At the end of each period of testing, wash out the cylinder and its contents with distilled water, and collect the washings in a glass vessel. Transfer one-half of this liquid to a separate vessel, and add a quantity of a neutral solution of hæmatoxylin or litmus, just sufficient to color the liquid. Then pour into the burette 100 septems of the prepared standard solution of the test alkali, and gradually drop it into the measured quantity of the washing collected—stirring constantly. As soon as the color changes, read off the quantity of liquid remaining in the burette. To find the number of grains of ammonia in 100 cubic feet of gas, multiply by two the number of septems of test alkali left in the burette, and move the decimal point one place to the left. This will give the percentage of ammonia. The gas may also be tested for ammonia in the following way: Take either yellow turmeric paper or prepared red litmus paper, and direct a small stream of gas on to it. If the gas causes the turmeric paper to turn a red brown, or the litmus paper a full blue in less than (say) a quarter of a minute, it will indicate the presence of ammonia in the gas.

Having dealt with the ammonia, I will now consider how and where to detect the remaining impurities—the carbonic acid, sulphuretted hydrogen, and bisulphide of carbon. At the inlet of the scrubbers, the gas should be tested with the eudiometer for carbonic acid and sulphuretted hydrogen. The process is as follows: Take a portion of the gas in the eudiometer, add a solution of acetate of lead, and shake well. Put the tube into water, and let it remain there for two minutes; then read off the extent of the absorption, which will give the percentage of sulphuretted hydrogen in the gas. Next add a few drops of a strong solution of caustic potash. Shake well, and let it rest for two minutes; then read off the absorption, which will give the percentage of carbonic acid in the gas. Test the gas in the same way at the outlet of the scrubbers; and the result will show what impurities have been taken out by these appliances. The other test for carbonic acid is lime water; and for sulphuretted hydrogen, slips of paper moistened with sugar of lead are used.

In order to purify gas from carbonic acid and part of its sulphuretted hydrogen and bisulphide of carbon, it is passed from the scrubbers through two purifiers charged with hydrate of lime. The work of the first lime purifier is principally to decarbonate the gas before it enters the second purifier. It should be tested for both of the above named impurities at the inlet, middle and outlet of the first purifier in the following manner: Take off first a portion of the gas at the inlet, and pass it through a small hand purifier charged with oxide of iron to eliminate the sulphuretted hydrogen; and then test for bisulphide of carbon. Test at the outlet of the purifier in the same way for carbonic acid and bisulphide of carbon. The test at the inlet will show what sulphur there is in the crude gas; that at the outlet the quantity of bisulphide of carbon and carbonic acid present. From this point the gas goes into the second purifier, which is charged with hydrate of lime; and the remaining sulphuretted hydrogen and the bisulphide of carbon will flow on with it. Here the lime is ready to remove another portion of these impurities; and the gas at the outlet should be tested in the same way as before. The result will show the number of grains of bisulphide of carbon in 100 cubic feet of the gas at this part of the apparatus. To remove the remaining sulphuretted hydrogen, the gas is passed into purifiers charged with oxide of iron. It should be tested at the inlet and outlet of each of these purifiers, in order to ascertain whether every trace of impurity has been removed. It should also be tested for bisulphide of carbon at the outlet of the gasholder, to see what quantity there is in the gas passing into the main delivering it to the consumers.

For testing gas for bisulphide of carbon, the Referees' sulphur test is employed. The following is a description of the apparatus: The gas is consumed in a small Bunsen burner with steatite top, mounted on a short cylindrical stand perforated with holes for the admission of air, and having on its upper surface a deep circular channel to receive the wide end of a glass trumpet tube. On the top of the stand, between the narrow stem of the burner and the surrounding glass trumpet-tube, are to be placed pieces (about 2 ounces) of commercial sesqui-carbonate of ammonia. The products both of the combustion of the gas and of the gradual volatilization of the ammonia salts pass upwards through the trumpet-tube into a vertical glass cylinder, packed with balls of glass, to break up the current and promote condensation. From the top of the cylinder there proceeds a long glass pipe or chimney, serving to effect some further condensation, as well as to regulate the draught, and afford an exit for the uncondensable gases. In the bottom of the cylinder is fixed a small glass tube, through which the liquid formed during the testing drops into a beaker placed beneath. At the end of each period of testing the cylinder and trumpet tube are to be well washed out with distilled water.

The liquid in the beaker and the water used in washing out the apparatus should be put into the same vessel, well mixed and measured. One-half of the liquid so obtained is to be set aside, and preserved for a week, in case it should be wanted; the other half put into a breaker, treated with hydrochloric acid sufficient in quantity to leave an excess of acid in the solution, and then raised to boiling point. An excess of barium chloride is now added, and boiling continued for 5 minutes. The vessel and its contents are to be allowed to stand till the barium sulphate settles, after which the clear liquid is to be poured off, as far as possible, through a paper filter, and the latter well washed with hot distilled water. A small quantity of the washings from the filter should be placed in a test tube, and a drop of a solution of silver nitrate added. If, instead of remaining perfectly clear, the liquid should become cloudy, the washing must be continued until, on repeating the test, no cloudiness is produced. Dry the filter and its contents, and transfer it to a weighed crucible. Heat this over a Bunsen burner, increasing the temperature gradually from the point at which the paper begins to char up to bright redness. When no black particles remain, allow the crucible to cool; and when it is nearly cold, place it for a time in a desiccator, over strong sulphuric acid, and again weigh it. The difference between the first and second weighings will give the number of grains of barium sulphate. Multiply this by 11, and divide by 4; and the result will be the number of grains of sulphur in 100 cubic feet of the gas. This is to be corrected for the variations of temperature and atmospheric pressure, which takes up a good deal of time.

There is another method in which the results of the sulphur test may be worked off, and it is much easier to manipulate than the one just explained. It is called the "cold" process, as there is no boiling connected with it. The following is a description of this short and simple plan, which is intended more especially for the use of those gas testers who are not qualified chemists, or who, through pressure of other duties, are desirous of simplifying the process of testing, so as to minimize the time necessary to be spent thereon. It is as follows: The liquid in the beaker, resulting from the condensation of the products of the test, is placed in a graduated vessel to which is added the washings of the trumpet tube and cylinder. The liquid is then made up to 1 pint by the addition of a sufficient quantity of distilled water. Of this liquid 1,000 grains are then taken and treated with sufficient hydrochloric acid to leave an excess of acid in the solution. By this means any carbonates are decomposed. An excess of the solution of barium chloride is next added, and the liquid allowed to stand until the thick white precipitate settles at the bottom of the vessel. The clear portion of the

1. The author has prepared this article expressly for students and young gas managers

liquid is then poured off and passed through a filter. When this is done, the thick sediment is poured on to the filter, and the latter well washed with distilled water by means of the wash bottle. The filter is then allowed to stand a short time to dry, after which it is transferred to a weighed platinum crucible, and heated over a Bunsen burner to a bright red heat. When no black particles remain in the crucible, turn off the gas, and allow it to cool. The crucible and its contents are then again weighed; and the difference between the first and second weighings will give the number of grains of barium sulphate resulting from the test. Note the quantity of gas consumed in the test; then, upon reference to the table, the number of grains of sulphur present in 100 cubic feet can be ascertained.

[To be Continued]

Some Characteristic Electric Burnouts.[1]

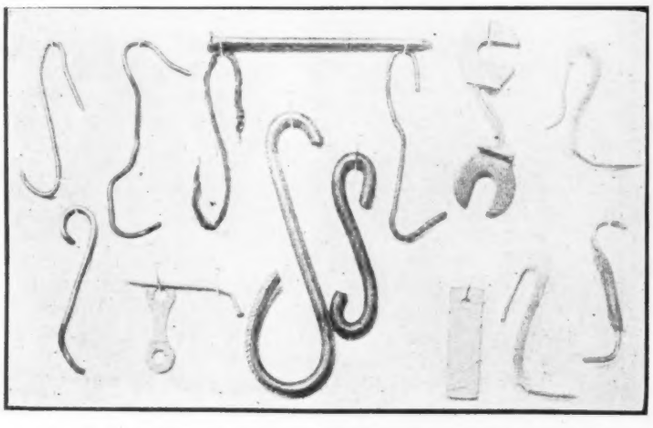
The Electric Wiring Code, issued by the National Board of Fire Underwriters, is the standard which now governs, throughout the United States, the installation of electric wiring and apparatus.

While the code is couched in perhaps as simple terms as the somewhat technical nature of the subject will admit, it is not always easy for the reader to see the force of all the rulings, and a clearer reading may possibly be made after seeing the results of some of the errors which the code seeks to correct.

A strong tendency exists, where the cause of a fire is not well defined, to attribute it to defective wiring. While this is in some instances unfair, it is equally true that many cases of bad wiring escape censure for the reason that the evidences of their existence are among the first things to be consumed.

In a paper on "Pranks of Electricity," read before the Northwestern Association of Fire Underwriters, Mr. W. T. Benallack, of the Michigan Inspection Bureau, said:

"Some of our most valuable information on the subject of bad wiring has been obtained from incipient fires which left complete evidences of their origin, or when the fire started in the presence of the occupant. In numerous cases fire has occurred at one point in the building due to certain defects in some distant part, and, if the fire has not been of too great dimensions, the origin is very apparent. For instance, fuses may have burned out and been replaced with a piece of copper wire, solder, a nail or a fuse of too great capacity to properly protect the smallest

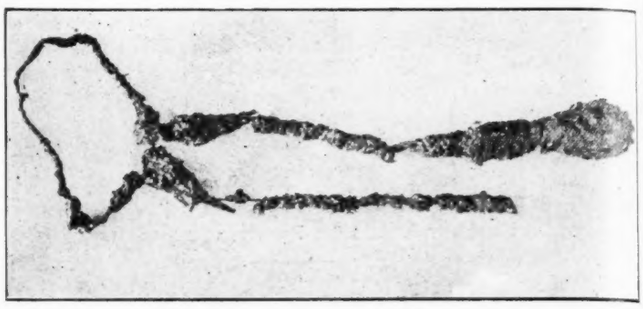


"Fuses."—Iron and copper wires, flexible cord, pins, nails and lead strips, found in practice as substitutes for copper tipped marked fuses.

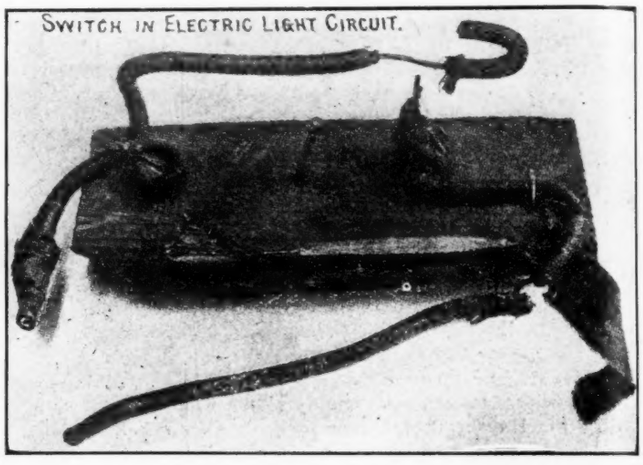
wire on the circuit. Later, when probably the same trouble had again arisen, instead of the fuse melting as designed, and disconnecting the circuit, the small wire has overheated, set fire to the insulation and finally to the building.

"Among a certain class of electrical men exists an impression that the underwriters are unjustly prejudiced against electricity. The impression is false and originated in the fact that it has fallen to the lot of the insurance companies to see that wiring is safely and properly installed, and, when found defective, has been condemned. In justice to the insurance companies I will say that in every case our bureau advocates the use of electricity as being the safest mode of illumination or power, our only condition being that the equipment be installed in accordance with the national code. The impression of prejudice, I am glad to state, is not shared by the superintendents or managers of the

1. *Insurance Engineering.*



Lamp Taken From Soap Factory.—Showing effect of soap drippings. Lamp burned in condition shown until lye ate through insulation, blowing fuse.



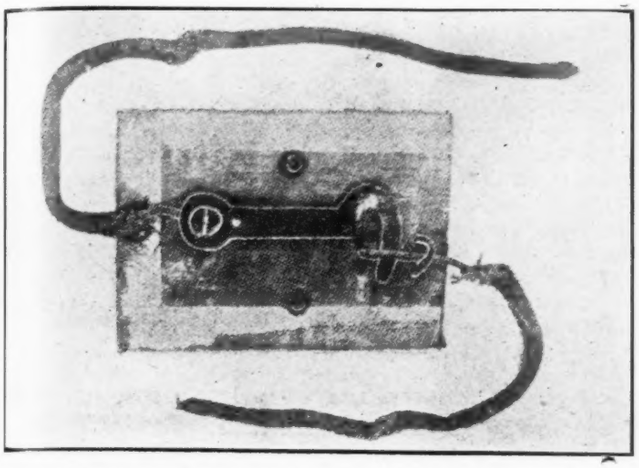
Single Pole Switch Used to Control Lighting Circuit.—Found in service in large mercantile risk.

Heating Effect.—Thirty-two-candle power incandescent lamp, left hanging against partition.

large and most important central station plants, for I have known numerous instances where the electric light company has refused to furnish current to equipments that were defective. Such action has materially assisted us in securing an improved standard of work, and, it is needless for me to say, has been greatly appreciated.

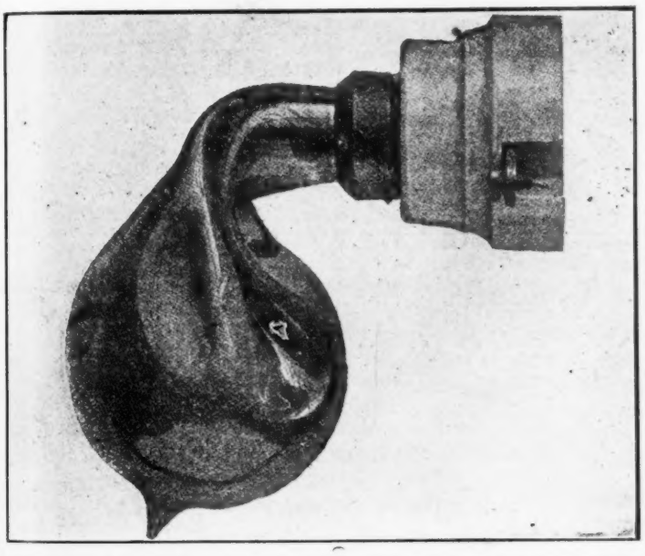
"What was long desired was a uniform set of electrical rules. This we now have, together with a list of approved fittings which is issued as a supplement to the rules, containing devices and materials upon which tests have been made under specifications given in the national code. It has been invaluable to inspectors as a convenient reference for the names of manufacturers of approved devices, and it has given us that which is more important—a uniformity of opinion that has obviated that difficulty which is bound to arise from a difference in the minds of experts.

"The use of the national electrical code is now practically universal, and electric light companies and contractors are being more impressed daily with the importance and necessity of doing a high grade of electrical work. It is manifestly most satisfactory from every point of

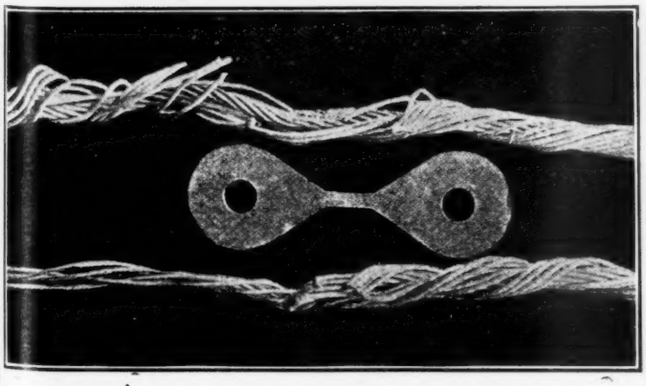


Remarkable Single Pole Switch.—Found in basement of large mercantile risk, used to control circuit of five 16-candle power lamps, 52 volts.

view. It means to the central station more modern and economical operation, as the removal of leakage due to grounds and imperfect insulation makes a saving in the coal pile. To the contractor it means that when the current is turned on the entire equipment is ready for



Heating Effect of Incandescent Lamp.—A stage hand in a theater at the close of a performance was ordered to put out an incandescent lamp near the switchboard on the stage. Instead of using the switch to cut off the current, probably because of ignorance, he wrapped a damp towel around the globe of the lamp, thus shutting off the light. Two hours afterward the night watchman found the towel lying on the stage smoldering. The glass globe had become so softened by the heat as to drop down at the neck, forming a right angle bend.



Effect of Short Circuit.—On mains of incandescent lighting plant, unprotected except by copper strip shown, which was used in a cutout in place of proper fuse metal.

use, instead of having to remove grounds and short circuits. It also puts his business on a higher standing, and has a tendency to keep it somewhat out of reach of the ordinary wireman, who, when getting out of a job, is located in business the next day, competing with his former employer, who has been in the business for years and has an expensive office to maintain. To the consumer it means that he has less interruption to service and the consequent annoyance of the lights going out when they are most needed. And from an insurance standpoint it means one of the greatest hazards reduced to a minimum.

"A few words regarding the manner of inspection. I believe that an inspector examining any equipment of importance should, after completing his survey, arrange to step into the office and explain the conditions thoroughly to the superintendent or electrician, if they have one. With but few exceptions I have succeeded in securing the promise to correct the defects at once, and I have felt confident that in a great many cases this could not have been done by a formal letter, unless by special pressure being brought to bear by the companies controlling the risk, and that is something that I avoid asking for unless necessary."

The illustrations are selected from a series of "Characteristic Burnouts," published in the Quarterly Fire Report, issued by the Electrical Bureau of the National Board of Fire Underwriters.

The Pan-Helio-Motor.

By R. M. W., in *Lightning*.

The other day I called upon Dr. Halver, of Washington, to hear all about his new prime mover, the "Pan Helio-motor." The mere name of this machine is to me a source of great delight, the syllables seeming to issue from one's lips like a song. There is none of the harshness that is to be found in such words as "automobile" or "traction engine" or "liquid air motor," to say nothing of some German machines with names like—well, perhaps they are better left undescribed. But "Pan-helio-motor!" It is a chant, a carol; try it for yourself the next time you are quite alone, and you'll agree with me. However, that is a digression, and I must proceed to the description of the machine itself and of what it can do. I was shown at once into Dr. Halver's "backyard," which was a large and well laid-out garden of about 2 acres in extent; but this, all the same, is a "backyard" in America. The Doctor was rather taken aback at my sudden appearance, as he was in rather scant attire—in fact, he had nothing on but a bathing suit and a shining silk hat. I introduced myself, and after a few minutes' chat I felt quite at home.

"You must feel the heat a good deal Doctor," said I, as a sort of apology for the fact that I could not keep my eyes off his somewhat strange rig out.

"Yes," said the Doctor, "I do feel it a good deal, although I have discovered the proper way to dress for this kind of work. You are no doubt surprised to see me wearing this silk hat?"

I signified that I was, somewhat.

"Well," he explained, "this hat is such a perfect reflector that it throws off and scatters the sun's rays from my head in the same way that my machine collects and concentrates them. I had a complete suit made out of old silk hats, but, although it was very cool, it was not of a sufficiently flexible material to give any great degree of comfort in wearing it, so I fell back upon this old bathing suit which I used at Manhattan last season. I find it answers very well, although it's not anything like so 'dressy' as the silk hat suit."

I perceived at once from the foregoing conversation that I had a genius before me, and became impatient to get at the real object of my visit, the pan-helio motor itself. The Doctor was very quick to notice my impatience, more by the acuteness of his observation than from the fact that I had unintentionally kicked him several times on his bare shins in my restlessness to get to the bottom of the "yard," where, I could see, the apparatus was erected. At last we arrived at the wonderful machine itself, and I began to ask the Doctor a few leading questions, as he showed that diffidence in explaining his discovery which is so common to all inventors, especially American inventors.

"What are the main features of your machine?" I asked.

"The main feature," he replied, "is the enormous amount of heat which I can generate with my apparatus."

"Excuse me," I remarked, "but does not the sun generate the heat, your apparatus merely collecting it and concentrating it upon a particular spot?"

The Doctor seemed a little ruffled at my question.

"I was not aware," he replied, "that you were a scientific man, or I should never have allowed you to see my apparatus. I never explain it to scientific men."

I thought this was a very safe line for the Doctor to adopt; I did not say so, but proceeded to disclaim any special scientific knowledge on my part. Somewhat reassured, the Doctor proceeded to explain how his apparatus could reflect the sun's rays on a focusing spot, and burn down a rocky mountain without so much as lighting a match. I was particularly struck by the great usefulness of a machine which could perform this miracle, which the Sc iptures set pretty high up on their list of difficult things to accomplish.

"Do you find much demand for the burning down of rocky mountains around here?" I asked.

"In the meantime," he replied, "business in the rocky mountain line is not very brisk, but I expect a large number of orders shortly when my invention becomes better known to proprietors of such nuisances as rocky mountains."

"Your invention is bound to prove most useful to railway engineers," I took the liberty to remark. "For instance, the burning of a hole through a mountain for a railway line to run through would be quite a simple matter, I suppose."

"Oh! certainly," said the Doctor, "the merest trifle."

"Is it the case," I asked, "that the melting of silver coins, glass tumblers, diamonds, etc., is performed almost instantaneously by your machine?"

"Yes," said the Doctor, removing his silk hat for a moment to mop his brow with a loose corner of the bathing suit, "all these and many other operations of equal usefulness are easily done by the pan helio-motor. The bricks I can make by my heat are so hard that one of them would smash a navvy's pick into a thousand pieces if he got in a good blow at it. This is a discovery invaluable to electrical engineers, for instance, who had given up looking for a material which would resist a pick. To protect their mains all they will have to do will be to put a layer of my bricks over the cables, and I guarantee that the average navvy will give up trying to get through to the wires after he has splintered his fourth pick."

I at once appreciated this point, as I am acquainted with a superintendent of electric mains, and have heard him discourse most forcibly on this very subject more than a few times. I was so grateful to the Doctor for giving my friend a chance of leading a less sulphurous existence in the future that I asked him on the spot to join me in a little refreshment at the nearest bar. He thanked me cordially, but refused, on the ground that his costume was apt to attract more public notice in the streets than could be desirable, even to an inventor. I at once saw the difficulty in which he was placed and postponed the adjournment to a more suitable occasion.

"Now, for a few experiments," said the Doctor, and grasping the controlling levers which actuated the reflecting mirrors, he directed the concentrated heat on a soaking wet plank of wood, and immediately the plank burst into flame. By regulating the heat to a slightly less intensity, about a dozen holes were bored through the plank before I had time to say "cocktail."

"What do you think of that?" said the inventor.

For a moment or two I stood speechless with wonder, but the Doctor reduced his heat by a few thousand degrees and playfully burned a small hole about $\frac{3}{16}$ inch in diameter and about $\frac{1}{2}$ inch deep in the calf of my leg, which quickly wakened me out of the brown stady into whsch I had fallen.

"Wonderful," I replied, carefully plugging up the hole with a square piece of lead pencil so that I might have something tangible to show my friends when telling them of my strange experiences. The Doctor then gave me an inkling of what will be the order of things when his sun motor becomes generally used. Coal will probably be a thing of the past as a fuel, as the pan-helio-motor will be very much cheaper, since it enables the heat of the sun to be controlled by a couple of levers. A pan-helio-motor in our backyard will enable us to do away with coal bins, ash bins and wood sheds, as coal fires will be quite out of date. The absence of the coal merchant's bill will be a pleasing feature of every home. In order to provide for the time when the sun is not available, the Doctor has invented a heat reservoir, but the principle of this reservoir is, I understand, a secret, which the inventor guards so jealously that he has not patented it, showing again that Dr. Halver "knows a thing or two." The heat is drawn off "like beer from a cask" from the tank containing the heat storing minerals. "Of course," the Doctor explained to me, "it is not absolutely necessary to use the heat reservoir, as the heat can be used to generate steam and drive dynamos, when the power so obtained can be stored by storage batteries. This, of course, would be quite a cheap method, but not a bit cheaper than storing the heat itself by means of the reservoir." From some remarks my friend, the main superintendent, had let fall in my hearing a few days before I had my doubts about the cheapness of the electrical method of storing. I thought it better, however, to say nothing of this to Dr. Halver, remembering his antipathy to anyone having, or pretending to have, scientific knowledge.

I made one remark to the Doctor, however, before leaving him, which I could see had set his inventive brain on a new tack.

"This invention," I said, "is a splendid idea where there is plenty of sunshine, but what about the countries where there are 5 days of rain to 1 of sunshine? If you could invent a 'pan-pluvio-motor' which would gather up and concentrate all of the energy possessed by the falling drops of rain, and turn them to a useful purpose, you would confer a blessing on the people of Great Britain, for instance, which would cause them to have a bronze statue erected to you in almost every town in the world."

"I'll think it over," said the Doctor.

I left him thinking, an interesting figure, with his silk hat crushed down over his ears, and the loose edges of his bathing suit flapping gently in the breeze.

The Production of Sulphuric Acid by Catalysis.

In a recent issue of the *Revue Générale des Sciences*, M. A. Haller describes in some detail the catalytic method of manufacturing sulphuric acid which has for some years been in use at the works of the Badische Anilin und Soda Fabrik. Many attempts in a similar direction have been made by others, the first being by Mr. P. Phillips, of Bristol, in 1831. All completely failed commercially, however, and it was only as the result of a very prolonged and painstaking inquiry into the reasons of these failures that success crowned the efforts of the Badische firm. Roughly speaking, the process consists in subjecting to the action of spongy platinum a mixture of SO_2 and air. The former body then oxidizes to SO_3, or sulphuric anhydride, which, on absorption by water, forms sulphuric acid. In the earlier attempts to use this process commercially, it was found that the platinum very quickly lost its power of effecting the combination required, and the efficiency was small, a large proportion of the SO_3 formed, being afterwards dissociated again. The Badische Company have overcome these difficulties. The degeneration of the catalytic powers of the platinum was discovered to arise from impurities in the SO_2, in particular from arsenic compounds, and by thoroughly purifying the gas before allowing it to come into contact with the platinum, the trouble has been completely obviated. The dissociation of the SO_3 after its formation is prevented by a careful regulation of temperature, which, whilst it must be sufficiently high to insure the union of the SO_2 and O, must be prevented from rising above the dissociation point of the SO_3. The Badische firm assert that concentrated acids are produced much more cheaply by this method than by the lead chamber process, whilst the commercial acids are made at least as cheaply and the capital expenditure is only two thirds that necessary for a lead chamber plant. M. Haller states that the Badische Company have recently patented their procedure, after having worked it for some years as a secret process. If the latter statement is correct, it would suffice to invalidate the patents in some countries.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Wyandotte Gas Company, of Bethlehem, Pa, the officers elected were: Directors, Liddon Flick, Morris Williams, A. L. Williams, R. J. Flick, E. H. Lawall and F. C. Page. President, Liddon Flick; Vice President, Morris Williams; Secretary and Treasurer, R. J. Flick.

Mr. Edgar T. Powers, formerly Superintendent of the East River Gas Company, Ravenswood, L. I., has been appointed General Superintendent of the Lincoln (Neb.) Gas and Electric Company.

Mr. C. J. Hayes has been appointed Superintendent of the Nebraska City (Neb.) Company.

Owing to the determination of the United States Steel Company to concentrate all operating departments of the constituent plants at Pittsburg, Mr. Charles M. Jarvis, Vice President of the operating department of the American Bridge Company, has resigned. Mr. Jarvis did not care to change his residence from New England.

In our issue for May 6th appeared an article descriptive of "The Municipal Gas Plant at Winnipeg, Manitoba," which originally appeared in the columns of *Engineering News*. We stated that this article was prepared by Mr. H. N. Rutan, the City Engineer of Winni-

peg. The real fact, however, is that the article was prepared by one of the staff of *Engineering News*, after an extensive correspondence with Mr. Rutan.

MR. S. M. HIGHLANDS, President and Superintendent of the Clinton (Ia.) Gas Light and Coke Company, writing under date of the 1st inst., says: To the Editors AMERICAN GAS LIGHT JOURNAL: I inclose you a clipping from one of our local papers of yesterday, which will give you some little bit of an idea as to what we are doing in the gas business this year. The clipping inclosed shows that we have contracted for and set this year 184 stoves since the 1st of February; in a city of 25,000 inhabitants, which already had in use 1,200 stoves, we do not think this is a bad record. As had been previously intimated to you, we have been pretty busy this season. We have recently closed a contract with the city for electric street lights for 25 years, at $65 per 2,000 candle power arc, on a moonlight schedule. The city at the same time granted us a 25 year contract to furnish gas and electric lights, the gas rate to be $1 per 1,000 cubic feet. The Stacey Manufacturing Company is now at work on our new 200,000-foot holder, and we have at least 125 men at work laying 8 miles of street mains, from 4-inch to 16 inch. We also have 15 gasfitters at work running services, setting stoves and piping houses; and, take it all in all, we are pretty busy. It is hardly necessary to state to you that it is very easy to sell gas at $1 per 1,000, and that the demand for gas is crowding us to a point where it will be necessary this summer to erect a new retort house with not less than 4 benches of 6's.

MR. A. C. HUMPHREYS has donated a sum of money for the construction of a chapel, in connection with All Angels' Episcopal Church, West End avenue and 81st street, which is intended to serve as a memorial to his two sons, whose lives were lost by drowning in the River Nile, Egypt, last February.

WE regret very much to be called upon to report the death of Mrs. Lillie, wife of the Hon. John Lillie, Secretary and Superintendent of the Port Townsend (Wash.) Gas Company. Deceased was born in London, Ontario, February 25, 1850, and subsequently removed to Fort Wayne, Ind. There she was united in marriage to Mr. Lillie, March 9, 1871. In 1890 they removed to Port Townsend at which place Mr. Lillie had been engaged to direct the gas works. The remains were removed to Fort Wayne for interment.

WE understand that Mr. John Van Meter, of Charleston, Ills., has purchased the interest in the Charleston (Ills.) Gas Company, heretofore owned by Mr. D. Turnbolt, of Lincoln, Ills., that Mr. Van Meter has been elected President of the Company, and that construction work will be taken up at once.

THE properties of the East Saginaw Gas Company and the Saginaw Gas Company, of Saginaw, Mich., have been consolidated under the title of the Saginaw Gas Company. The officers of the concern are: T. E. Dorr, F. H. Potter, Jas. B. Peter, T. A. Harvey, A. G. Hodenpyl and H. D. Walbridge; President, H. D. Walbridge; Vice-President, George B. Morley; Secretary and Treasurer, Bernard C. Cobb.

THE property owners on the west shore of Lake Cayuga, between Ithaca and Glenwood, have petitioned the proprietors of the Ithaca (N. Y.) Gas Company to extend their main system through the district named.

THE Capital City Gas Light Company, of Des Moines, Ia., will this season extend its main system to and through South Des Moines and Clifton Heights.

A CORRESPONDENT sends the following note: "Some time ago the Board of Directors of the Lancaster (Pa.) County Railway and Light Company, which was incorporated recently under the laws of New Jersey, and which was organized for the purpose of operating the entire electric railway systems and the Edison Electric and the Lancaster Gas Light and Fuel Companies, met and elected the following officers: President, William B. Given; Secretary and Treasurer, Oscar M. Hoffman. President Given, of the Conestoga Traction Company, who has been chosen President of the new corporation, stated that arrangements have been perfected for the purchase of the stock of the Conestoga Traction Company, the Lancaster Gas Light and Fuel Company and the Edison Electric and Illuminating Company. The new corporation will assume charge July 1st."

AT the annual meeting of the Wilmington (N. C.) Gas Light Company the officers elected were: Directors, M. J. Heyer, G. H. Smith, George R. French, W. L. Parsley, Junius Davis, Hugh MacRae and W. W. Randolph. President, Hugh MacRae; Consulting Engineer, W. W. Randolph; Secretary and Treasurer, R. J. Jones; Superintendent, H. Woolcott.

WE understand that Mr. Fred. H. Shelton and associates have purchased the plant and franchises of the Columbia (S. C.) Gas Light Company. The capital stock has been increased from $50,000 to $100,000.

THE gas and electric lighting plants, and the street railway lines of Lynchburg, Va., have been consolidated under the title of the Lynchburg Traction and Light Company. The President and General Manager of the consolidated enterprise is Mr. Richard D. Apperson, and Mr. R. Colston Blackford is the Secretary and Treasurer.

THE Governor of Pennsylvania has reappointed Mr. James W. Patterson, of Pittsburg, to be inspector of illuminating gas and gas meters for Allegheny county, for the full term of three years, from March 25, 1900. This appointment was hung up for well over a year, but in the end justice was done. Mr. Patterson has performed the duties of this position with celerity and fairness.

MR. CHARLES W. BENNETT, of Long Branch, N. J., has been appointed Superintendent of the Red Bank station of the Consolidated Gas Company, of New Jersey, succeeding Mr. James Coles. The latter has been named to take charge of the Company's station at Asbury Park.

IT is said that Mr. Wesley S. Block, of Brooklyn, N. Y., and associates propose to construct forthwith a gas works in the city of Mexico, the operating concern to be known as the Mexico City Light, Heat and Power Company. The Company is capitalized in $5,000,000.

AT the annual meeting of the Ottawa (Can.) Gas Company, the officers elected were: President, John Oates; Vice President, A. W. Clemow; Secretary and Treasurer, D. B. Gardner. The annual reports showed that the Company had enjoyed a prosperous year. We regret to note that Vice-President Clemow's health is still a cause of anxiety to his many friends.

COMPLETING our prior reference to the consolidation of the gas interests of Saginaw, Mich., it may be said that the proprietors have awarded a contract for the reconstruction of the plant to the Western Gas Construction Company, of Fort Wayne, Ind. The contract specifies the complete reconstruction of the condensing and purifying apparatus according to the improved system of the Construction Company.

MR. R. S. FISHER, of New Orleans, La., forwards the following, under date of the 3d inst.: "Mr. H. H. Pearson, Jr., has agreed to pay the New Orleans Gas Light Company a 3 per cent. semi-annual dividend on the capital stock of the Company on the 1st of July next, in accordance with a resolution adopted by the New Orleans Gas Light Company on April 8th. This resolution is as follows: '*Be it Resolved* by the Board of Directors of the New Orleans Gas Light Company, that the President of this Company is hereby authorized and empowered to contract and agree with H. H. Pearson, Jr., lessee, that the said H. H. Pearson, Jr., shall, on the 1st day of July, 1901, pay this Company in cash $112,500, being 3 per cent. semi-annual dividend, at the rate of 6 per cent. per annum, upon the capital stock of this Company, in full satisfaction and discharge of the said H. H. Pearson, Jr.'s agreement to pay a fixed sum per diem for each and every day that may elapse between the date of his taking possession of said property under said lease and the 1st day of July, 1901, and in full satisfaction of all the right and claim of this Company in and to the net profits that may accrue from the 1st of January, 1901, to the date of the delivery of the property to the said H. H. Pearson, Jr. The object of this agreement being to simplify the settlement relative to such profits at the time of such delivery, so that at the time of such delivery said Pearson will take over the assets and unsettled accounts and obligations of the Company arising during said period from Jan. 1, 1901, to the date of delivery without any necessity of separating or adjusting said accounts.'"

MR. F. M. TRAVIS, Superintendent of the gas branch of the Torrington (Conn.) Electric Light Company's business, has resigned that post to accept a responsible position with the New Haven (Conn.) Gas Company.

(*Concluded on page* 734.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

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AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, MAY 13, 1901.

(*Continued from page 733.*)

IT is quite likely that the proposed gas plant for Shelby, O., will be constructed this summer.

AT the annual meeting of the United Gas Improvement Company the Directors elected were: George Philler, P. A. B. Widener, William L. Elkins, C. A. Griscom, W. W. Gibbs, S. T. Bodine and Thomas Dolan. The latter was re-elected President.

THE Erie (Pa.) Gas Company has increased its selling rate for gas supplied on fuel account from 60 cents to 80 cents per 1,000 cubic feet.

THE works of the Los Gatos (Cal.) Gas Company are to be rebuilt, and it may with truth be said that it is high time they were reconstructed.

Engineering News says that the annual report of the General Electric Company announces a profit of $6,244,433 on the business of the last year; of this profit $1,968,289 was paid in dividends and the remainder placed to surplus account. The sales department reports total orders received in the year ending January 31, 1901, amounting to $37,969,541; the largest total for any preceding year was $17,431,327, in 1899. In the last year over 150,000 separate supply orders were received averging over $60 each, and 12,000,000 incandescent lamps were ordered. Orders were also received for over 350,000-horse power of alternating and direct current motors; and more than 600,000 horse power of electric motors and transformers for various purposes. Among the contracts closed was one for the equipment of a long distance transmission plant to operate mining machinery at the Kolar gold fields, in Mysore, India; this plant, a pole-line nearly 100 miles long, for supplying 4,000-horse power to the motors. This enormous increase in business has required the expenditure of about $1,200,000 in extending the plant at Schenectady; these factories now cover 2,500,000 square feet of floor space and employ over 12,000 people. The report itself is a model document, in the information given to the stockholders as to the business and financial status of the Company.

The Market for Gas Securities.

All things come to those who wait, and the hibernating bear contingent had their sunshine last Thursday. Availing themselves of the opportunity they squeezed points out of quotations as readily as the financiers put water into "securities." So far, however, as sensible reactions are concerned, the miserable work of Thursday will stand for years as a monument to the asininity of those mainly concerned in its development. Whatever the value of Northern Pacifics has to do with the value of Consolidated gas is beyond the writer's ken; but the cold fact is the reaction or unsettlement in the first caused the latter to drop, net, 15 points in 24 hours.

Better ideas of values prevail to-day (Friday), for Consolidated closed at 217 bid; asked 218¾. Those on the inside know very well that the developments shortly to be made in it should and will put the stock to well over 250. Another queer feature of the break was the record made by Brooklyn Union. The latter for the first, and likely the last, time in its history passed Consolidated in quoted value. Some Consolidated was garnered by clever buyers on the break.

The rest of the gas share market suffered much nominally, particularly, Peoples, of Chicago, which reached the low point of 98¼. It is worth more to-day intrinsically than it ever was at its highest recorded quotation. Keep a good look out for Baltimore Consolidated. Those who hold gas shares of the standard sorts need have no fear for the future.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MAY 13.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	217	218¾
Central Union, Bonds, 5's.	3,000,000	1,000	106½	107
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	120	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	310	320
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	109	110
Northern Union, Bonds, 5's.	1,250,000	1,000	104	104¼
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	106	108
Richmond Co., S. I	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	135	.
Preferred	5,000,000	100	155	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	210	220
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	⅞	1
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	26	30
" 1st Mtg. 5's	509,000	1,000	92½	95
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	7	9
" " Bonds, 5's	5,250,000	1,000	75	76½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati G. & C. Co.	8,500,000	100	209½	210
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,730	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore	11,000,000	100	61¾	62¾
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12½	14½
" Con. Mtg. 5's	380,000	1,000	81½	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	..	89
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	35	40
Fort Wayne	2,000,000	..	52	..
" Bonds	2,000,000	..	.	38
Grand Rapids Gas Lt. Co..	1,000,000	50	103	105
" 1st Mtg. 5's	1,225,000	1,000	..	..
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	55	60
" Bonds, 6's	2 650,000	..	94½	93
Jackson Gas Co	250,000	50	70	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	101½	103
Laclede, St. Louis	10,000,000	100	82	84
Preferred	2,500,000	100	95	99½
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100	55	60
Bonds	1,000,000	1,000	56	58
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.	400,000	100	72	77
" 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184½
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	110¼	111x
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	47¼	47½
St. Paul Gas Light Co.	1,500,000	100	51	53
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's..	2,465,000	1,000	88	90¼
St. Joseph Gas Co.	1,000,000	100	36	38
" 1st Mtg. 5's	751,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	17½	19
Bonds	1,612 000	1,000	91	93
Washington, D. C	2,600,000	20	200	201
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	100	101¼
Bonds, 5's	4,000,000	..	106½	107½
Wilmington, Del.	600,000	50	200	201

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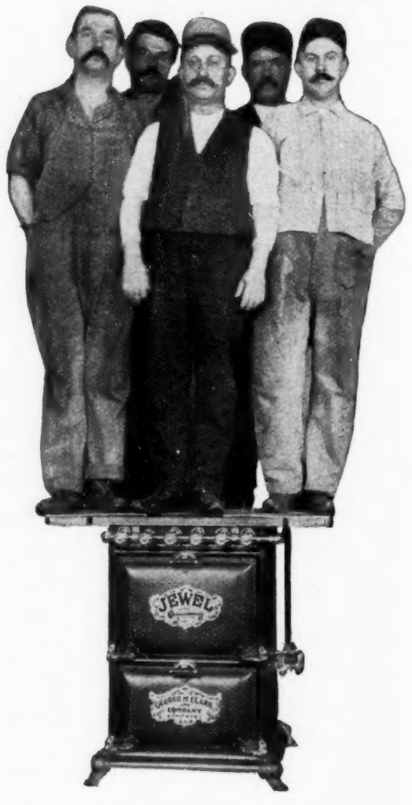

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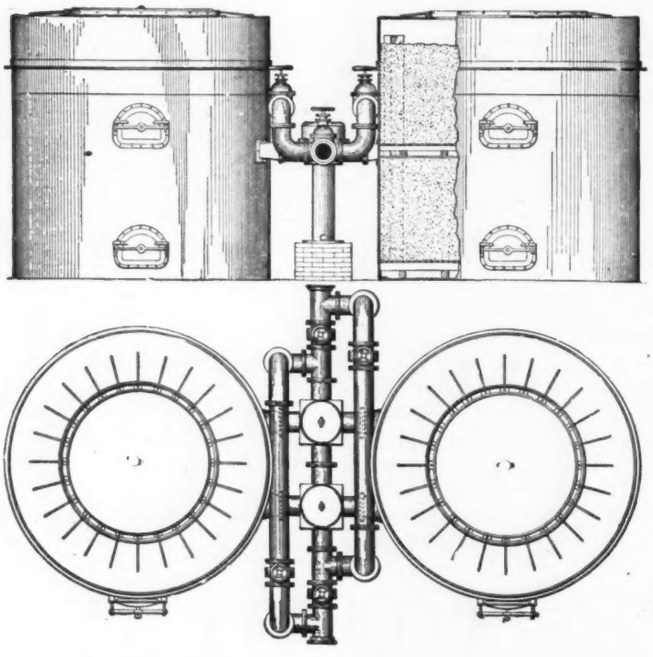

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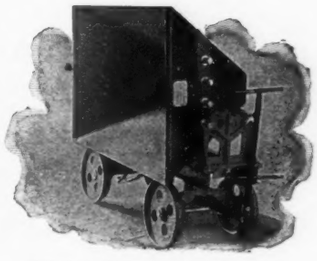

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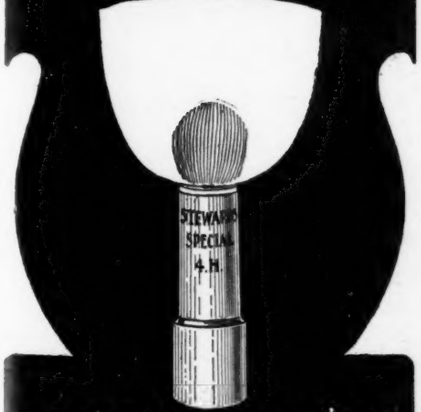

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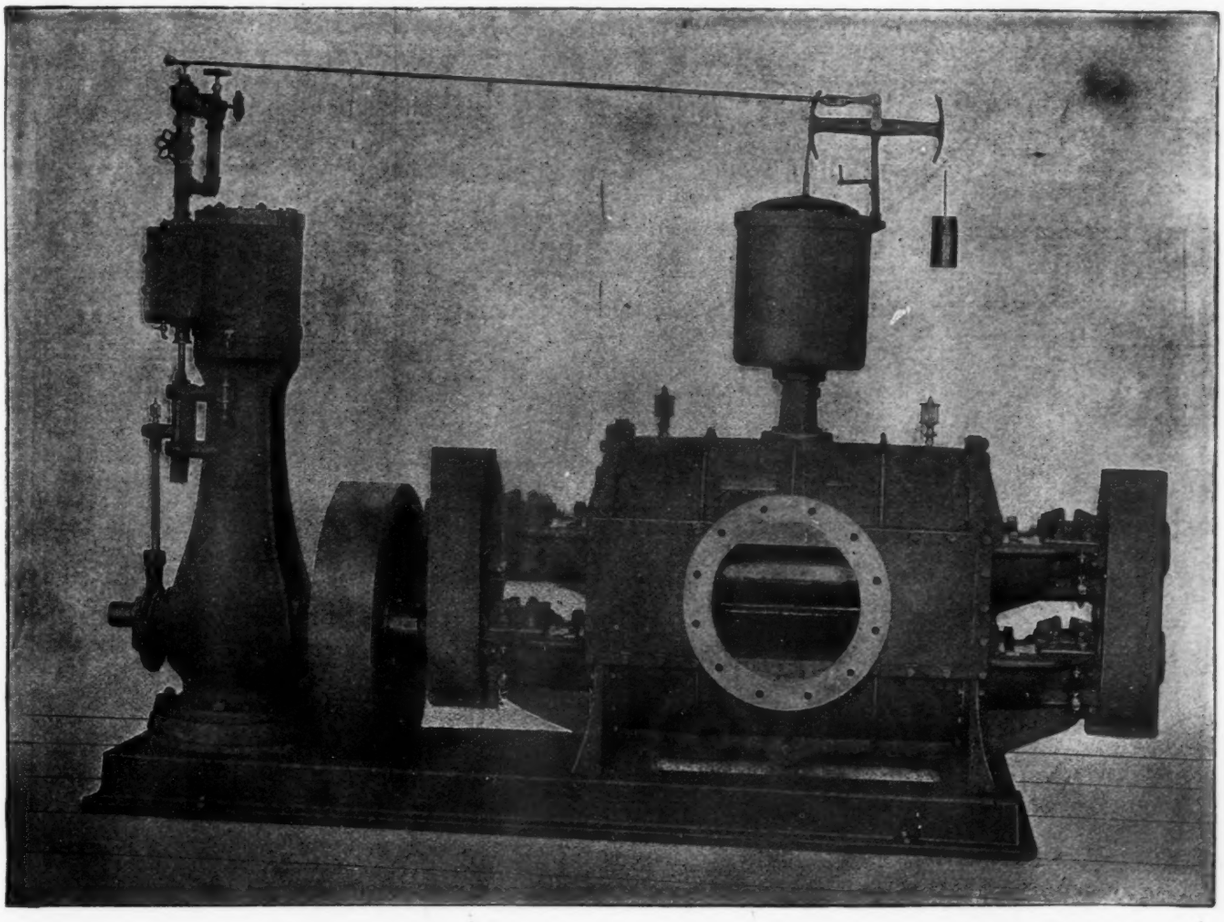

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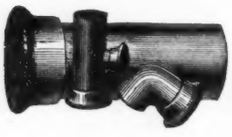

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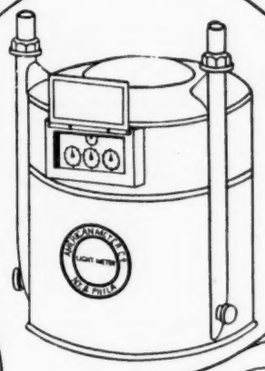
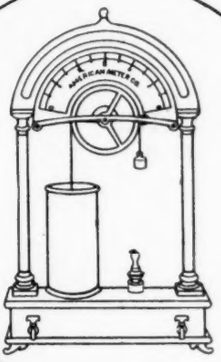
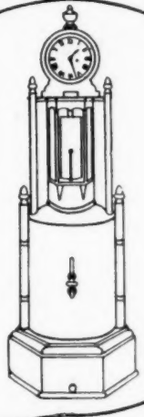
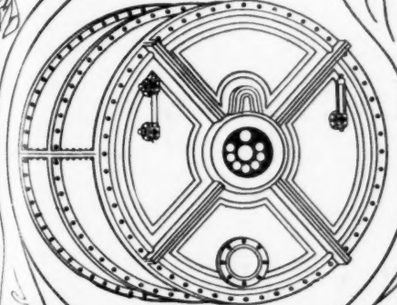








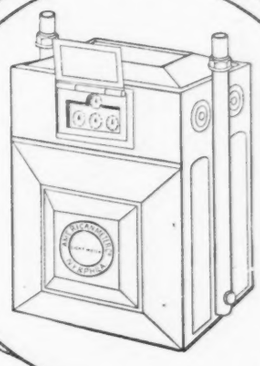
PUBLIC LIGHTING TABLE.

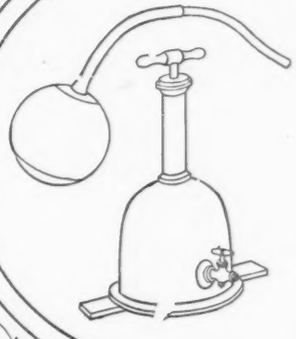
MAY, 1901.

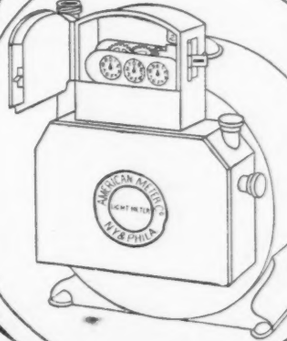
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Wed.	1	3.10 AM	4.00 AM	6.45	4.00
Thu.	2	No L.	No L.	6.45	4.00
Fri.	3	No L. FM	No L.	6.45	4.00
Sat.	4	No L.	No L.	6.45	4.00
Sun.	5	7.30 PM	9.50 PM	6.45	4.00
Mon.	6	7.30	10.40	6.45	4.00
Tue.	7	7.30	11.30	6.55	3.40
Wed.	8	7.30	12.10 AM	6.55	3.40
Thu.	9	7.30	12.50	6.55	3.40
Fri.	10	7.30	1.30	6.55	3.40
Sat.	11	7.30 LQ	2.00	6.55	3.40
Sun.	12	7.40	2.40	6.55	3.40
Mon.	13	7.40	3.10	6.55	3.40
Tue.	14	7.40	3.40	7.00	3.30
Wed.	15	7.40	3.40	7.00	3.30
Thu.	16	7.40	3.40	7.00	3.30
Fri.	17	7.40 NM	3.40	7.00	3.30
Sat.	18	7.40	3.40	7.00	3.30
Sun.	19	7.40	3.40	7.00	3.30
Mon.	20	7.40	3.40	7.00	3.30
Tue.	21	7.40	3.40	7.10	3.15
Wed.	22	10.20	3.40	7.10	3.15
Thu.	23	10.50	3.40	7.10	3.15
Fri.	24	11.20 FQ	3.40	7.10	3.15
Sat.	25	11.50	3.40	7.10	3.15
Sun.	26	12.20 AM	3.30	7.10	3.15
Mon.	27	12.50	3.30	7.10	3.15
Tue.	28	1.10	3.30	7.15	3.15
Wed.	29	1.50	3.30	7.15	3.15
Thu.	30	2.20	3.30	7.15	3.15
Fri.	31	No L.	No L.	7.15	3.15

TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45







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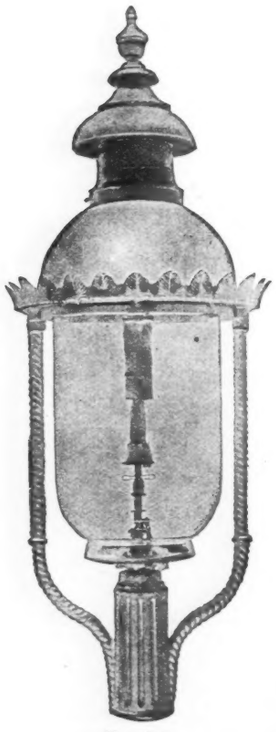
.... OF AMERICA ....



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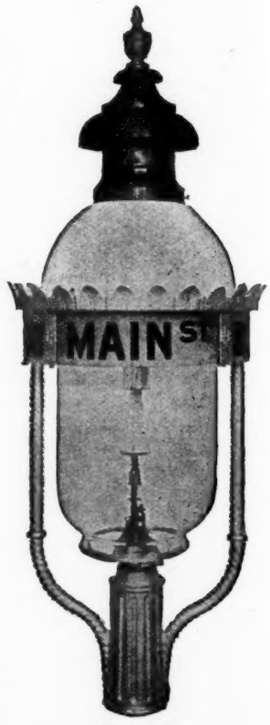

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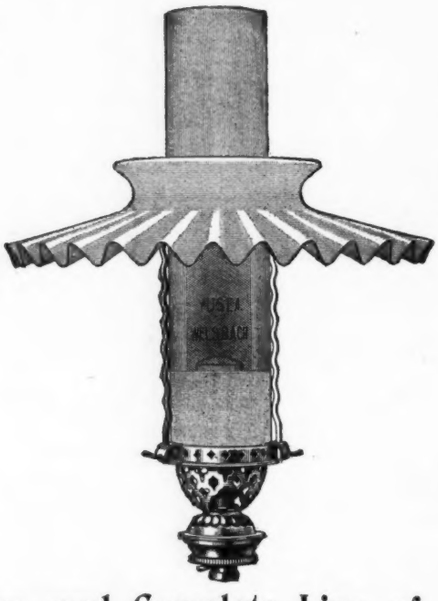

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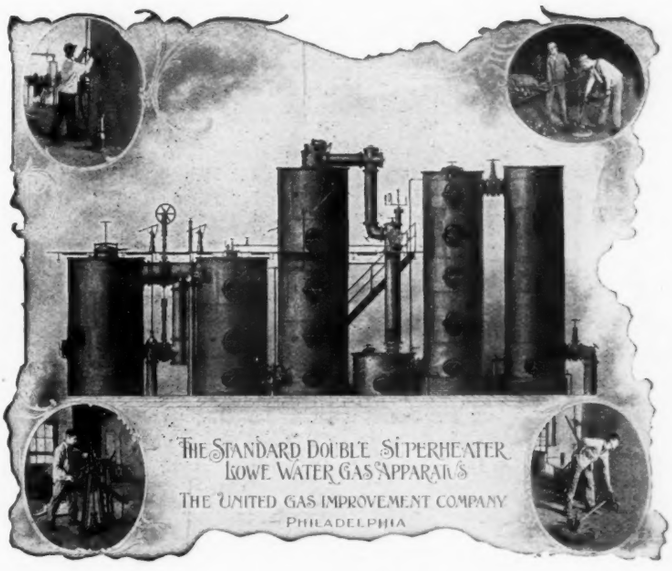
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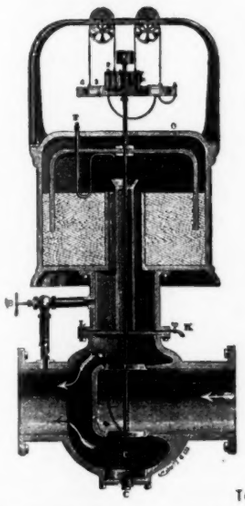

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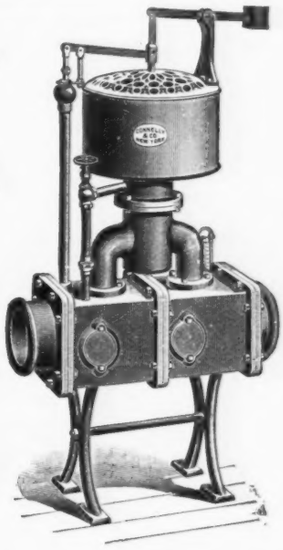

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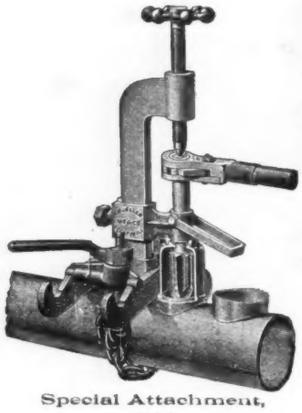

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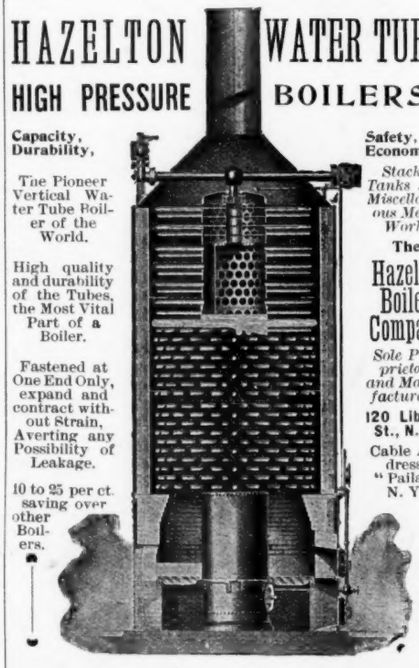

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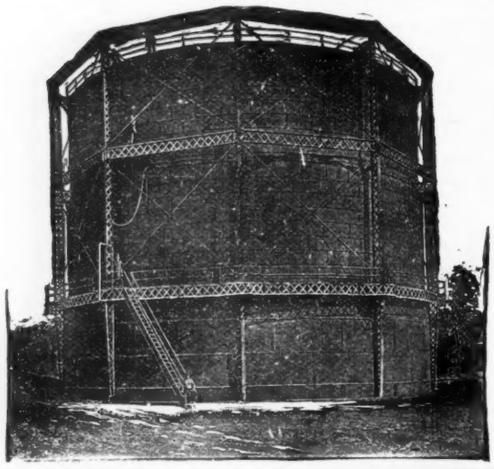

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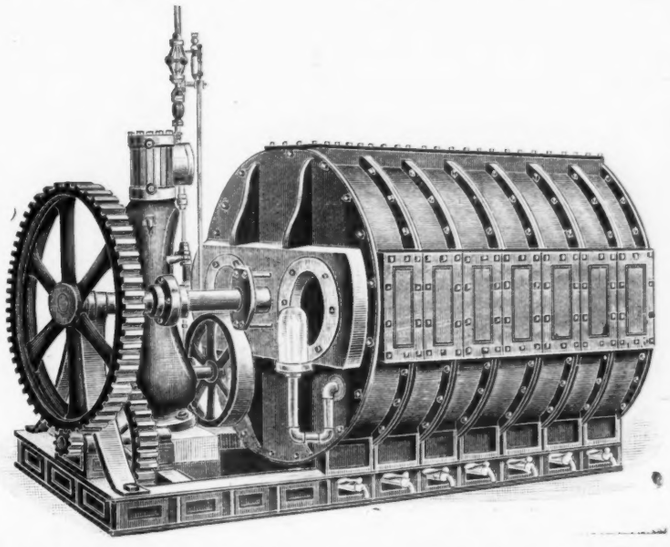

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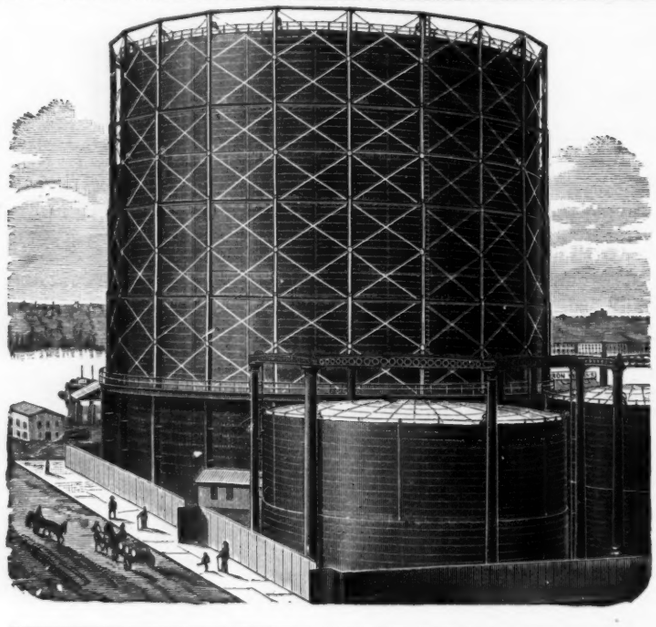

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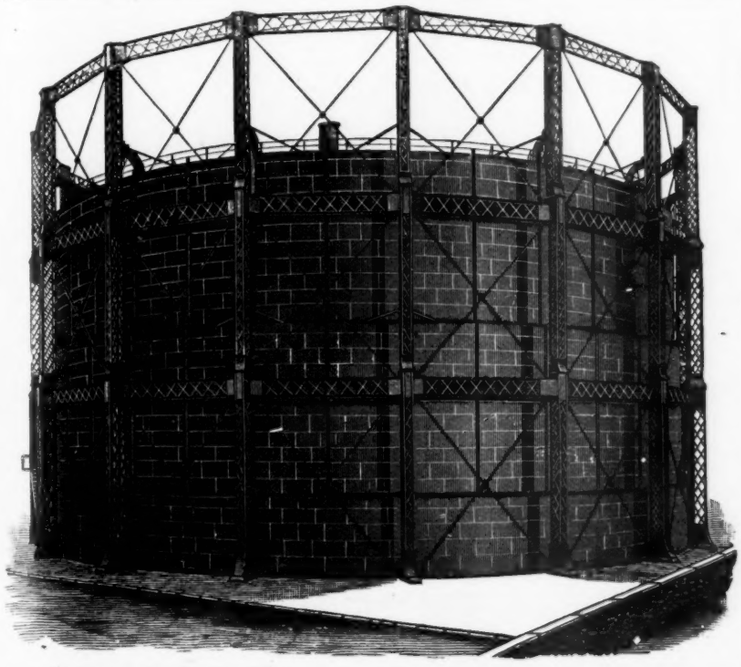

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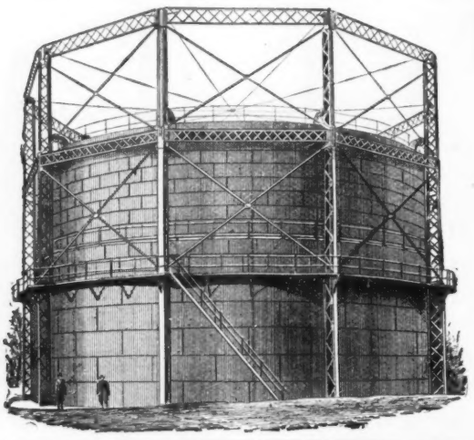

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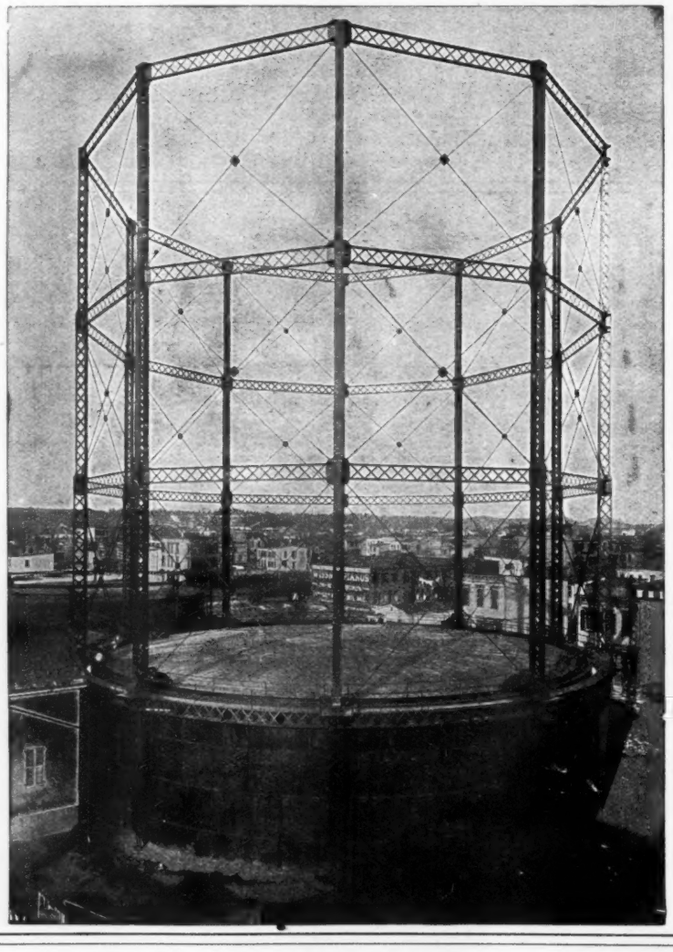

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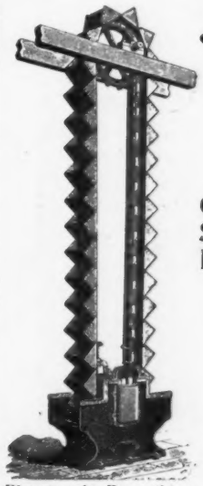

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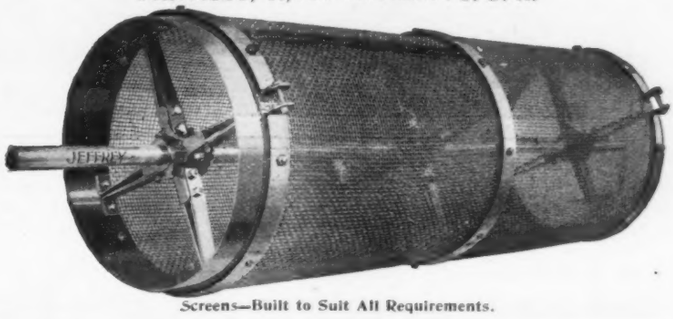

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